

August 25, 1958

Aviation Week

Including Space Technology

75 cents

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Navy Reveals
How Submarine
Fires Regulus II

Grumman Gulfstream Makes First Flight



First Flight Report on U.S. Turbine Helicopter

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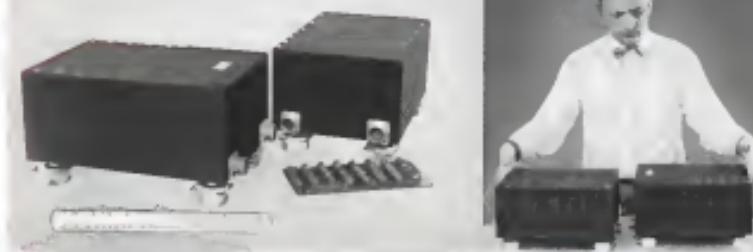
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AVIATION CALENDAR

Sept. 17-18 1975 Freshmen Flug Display and Freshmen Society of British Airsoft Competition, Freshmen Ring.

Sept. 8-10 1975 Cryptone Engineering Competition, Cryptone Institute of Technology, Cambridge, Mass.

Sept. 4-6 1975 M.I.T. Science Fair Meeting, Cambridge University, Cambridge, Eng.

Sept. 4-5 1975 International Congress of the American Sciences, Puerto Rico.

Sept. 9-11 1975 National Conference on Applied Mathematics, Engineering, Aerospace, Manufacturing, Chemical, Dr. D. J. Parnell, 2000 Tech Engineering, Univ. of Michigan, Ypsilanti, Mich.

Sept. 11-13 1975 Annual Engineers Meeting and Conference, Northeast Chapter, American Society of Apparatus Engineers, Mississippi, August, Meridian, Miss.

Sept. 14-16 1975 Multi-States American Rocketry Competition, University of Michigan.

Sept. 17-19 1975 Annual International Astronomical Conference & Exhibit (International), in the United States of America, Philadelphia, plus Conference Hall, Philadelphia, Pa.

Sept. 22-24-1975 Convention of the National Association of Broadcasters, in the International Hotel, Philadelphia, Pa.

Sept. 22-24-1975 Meeting, Professional Group on Telecommunications and Space, Central American Hotel, 3rd Avenue, New York, N.Y.

Sept. 27-28 1975 Scrabble, Annual, Narragansett, Rhode Island, Scrabble, Inc., Narragansett, Rhode Island.

Sept. 28-29 1975 All-American National Women's Forces Annual Helicopter Competition, Airshow, Atlantic City, New Jersey, Atlantic City, N.J.

Sept. 25-26 1975 Annual Meeting, American Gas Association, Pennsylvania, Philadelphia, Pa.

(Continued on page 6)

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TRANS-SONICS

Precision Transducers

AVIATION CALENDAR

[Continued from page 9]

Sept. 28 Oct. 3-11-14k Meeting Electrical Society, Clinton Library, Ontario, Canada

Sept. 29-Oct. 1—National Aerospace Meeting Society, Inc., the Ambassador, Los Angeles

Sept. 30-Oct. 1—National Aerospace and Western Test Show, American Society of Test Engineers, Shrine Auditorium, Los Angeles, Calif.

Oct. 1-2—Conference on Radio Interference Reduction sponsored by Atomic Energy Commission, University of Illinois, Urbana, Ill. and Defense Department, Division of Science and Industry, Chicago, Ill.

Oct. 1-3—National Airports Conference, University of California, San Diego, Calif. Sponsored by American Assoc. of Airport Executives and the CAN.

Oct. 1-3—National Aerospace Meeting, Society of Experimental Test Pilots, Jerry Brown Blvd., Brooks AFB, Calif.

Oct. 6-7—National Symposium on Parallel Range and Space Transmissions sponsored by Institute of Radio Engineers and George Washington University, Lower Mathematics, Washington, D. C.

Oct. 10-15—1959 Joint Meeting, Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, Clinton, Ontario, Ontario, Canada.

Oct. 11-13—1959 International Economics and Conference, Great Italy

Oct. 9-10-11—Annual Aviation Spark Plug and Ignition Conference, Champion Spark Plug Co., Akron Hotel, Toledo

Oct. 9-10-11—Annual National Noise Abatement Seminar sponsored by American Acoustics Foundation, Hotel Plaza, Chicago, Ill.

Oct. 14-15—1959 ASME Joint Lubrication Conference, Statler Hotel, Los Angeles, Calif.

Oct. 15-16—Annual National Personnel Conference, Hotel Stevens, Chicago, Ill.

Oct. 15-17—Annual Meeting, Southeastern Airport Managers Assn, The Palms Beach Terrier, Palm Beach

Oct. 18-19—Annual Meeting, Assn of the United States Army, Shoreham Park Hotel, Washington, D. C.

Oct. 21-24—1959 National Vacuum Symposium, St. Francis Hotel, San Francisco, Calif.

Oct. 21-25—1959 National Simulation Conference, sponsored by Institute of Radio Engineers, Professional Council on Military Computer, Statler Hotel, Dallas, Tex.

Oct. 21-25—1959 Annual General Meeting of the International Air Transport Assn, New York, N. Y.

Oct. 27-28—Great Canadian Conference on Aeronautical & Navigational Electronics, Institute of Radio Engineers, Lead Belly Hotel, Baltimore, Md.

Oct. 30-Nov. 1—Electronics Devices Meeting sponsored by Institute of Radio Engineers, Statler Hotel, Washington, D. C.

Nov. 19-20—International Conference Physics and Mechanics of the Atmosphere and Space sponsored by the School of Aeronautics, San Antonio, Tex.

TIMESAVERS

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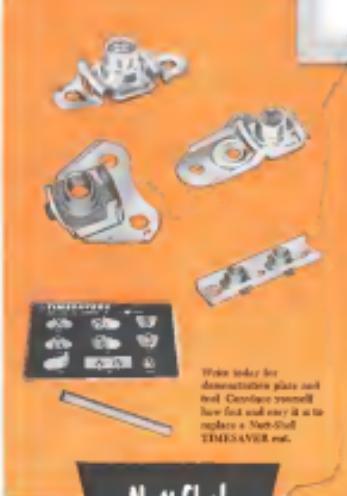
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Architect "A", Materials
and Processes,
Engineering Department,
Convair, Ft. Worth



Nut-Shef's idea, dropped into the suggestion box at Convair, Ft. Worth, pointed out that nearly man-hours are required to replace those nuts which become damaged in the event that replacement is necessary. "It," she said, "will save 2 log and one lag fastening nuts were replaced with plate nuts having removable threaded elements; replacement cost could be reduced. Threaded nuts indicate that two men must now spend 10 minutes on drilling out the roots of an installed nut, whereas one man can replace the nut element, if removable, in 5 seconds."

Since maintenance is a part of the Air Force contract with Convair, a division of General Dynamics Corporation, the manufacturer is interested in improved, time-saving components. Nut-Shef was rewarded for her suggestion.

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WEATHER AND RADIO

HOW WEATHER CONDITIONS AFFECT THE PROPAGATION OF RADIO WAVES

Radio reception may vary from poor to excellent, depending on the temperature strata. Temperature affects the refraction characteristics of the atmosphere. This can result in both reception over great distances on VHF channels.

Precipitation static—ice crystals, snow flakes and rain droplets striking aircraft can cause crackling in headphones.

Static due to lightning discharges. These occasional bolts and craters can be picked up at considerable distance. It is often poor and causes of thunderstorms accuracy.

How to minimize static: Change altitude if it can be done safely. Decrease speed in rain or snow storms. When possible, avoid dry snow and cause clouds composed of ice crystals. Keep radio volume turned low to reduce background noise. It is preferable to use a higher frequency broadcast station for ADF bearing instead of low frequency range stations. During periods of static, push headphones over temples when not listening—to keep fingers in contact.



Atmos. Barometric, associated with magnetic storms. These two unusual phenomena exist concomitantly. There is an International Bureau of Navigation Bureau of Standards (5 or 10,000) kilobecyles for forecasts of periods of press storms.

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EDITORIAL

First Shot at the Moon

The first U.S. attempt at lunar exploration launched from Cape Canaveral on Aug. 17 by the Air Force was a significant reduction in the exploration of outer space. Like all early experimental flights in attempts to probe the frontiers of the unknown, it provided considerable knowledge with which to bolster the opportunities for success on subsequent attempts. Furthermore, an ensuing increase in technical capability by the USAF industry team that was able to take a directive from the Advanced Research Projects Agency, issued last March and timetable it into a four-year plan, made it possible to launch from a Cape Canaveral pad five months later at the exact time and date specified. Regardless of the failure of the probe in the air after launch, the fact of having it get off the pad at the exact predetermined time is one that all technical people will appreciate.

Participants in this remarkable record include the USAF Ballistic Missile Division headed by Maj. Gen. Bernard Schriener, Douglas Aircraft Missile Division, which provided the Thor first stage, Aerop, which built the second stage, Allis-Chalmers for the solid propellant third stage, the Space Technology Laboratories of Ramo-Wolfe, which had overall technical responsibility of the program and development of controls for the second and third stages and development of the probe itself. This team was backed by a large number of component manufacturers and suppliers whose contributions also are vital to the success of any such major project.

The failure in the Thor first stage rocket engine appears to have been caused by a faulty fuel line. The fact of the type of missile failure that is bound to occur even so often regardless of the amount of testing that precedes a launch. But it also serves to recall the warnings Dr. Walter Dornberger, wartime commander of the German V-2 development program at Peenemuende, sounded early in his own ballistic missile development program. He pointed out that most of the early V-2 flight failures came, not from major systems, but from "boilerplate" hardware such as valves, fuel lines, etc. which were not specially developed but taken off the shelf from general industrial use. He pleaded for an in-plant launch in the garage a special development program for space hardware able to take the tremendous wrench of stress and strain imposed during a ballistic missile mission. These type programs are now well along. But they did not come into being until we had suffered the same type failures of small components that plagued the V-2.

As a nation we have made great strides in organizing our military research and development program since the World War II days of the Army Corps Engineering Division at Wright Field and the Army Ordnance research section. But we still have a long way to go in having a sound, broad-based research of basic research and then having effective organization to apply the new knowledge to military weapons development. Army, Navy, Air Force and the Department of Defense are all aware of this problem. They are striving with sincerity to be even better, to formulate solutions. But the tangle of bureaucracy, broad-scaled leadership and block-keeping control of research programs are still keeping this effort well short of its genuine technical capability.

We highly agree with Defense Secretary Neil McElroy's information philosophy on this matter when he explained:

"Under the American way, both government and business are free to compete, to innovate and improve products. The public is informed. This is in stark contrast to the strict controls which were imposed during the Soviet era, when even the most advanced technology was denied to the public."

In this connection, American Ward has been active in ensuring that Soviet failures both in their ballistic missile development program and in attempts to probe the lunar environment do not remain "classified failure" (see page 23).

One aspect of the public information policy should be noted in passing as it is symptomatic of the type of "thought control" operation now being organized by a few Pravda bureaucrats who also prefer the absolute government press control of "Pechat" and "Izvestia" to the American free, and often critical, press. This is the public rebuke dealt to Lt. Gen. Siemel Anderson, commander of the USAF Air Research and Development Command, for informing the American people of the correct date of the first lunar probe launching. The fact that this probe was actually launched on Aug. 17, the date specified by Gen. Anderson in his Misawa speech of June 10 (NW June 16, p. 282), and that official confirmation has now been given that another attempt will be made in September, is he said, is absolute proof of the veracity of his original statement.

The proximity of the moon to the earth and the period when the sun is in a position to light the backside of the moon for photography are matters of astronomical calculation as well known to the Soviets as to our own scientists. There was absolutely no shred of genuine military security in Gen. Anderson's statement!

Yet his statement was first officially denied by Gen. Johnson, head of the Advanced Research Projects Agency, who now emerges on the record as a source of dubious authenticity. Thus, obviously at Mr. John's insistence preceding, the Secretary of the Air Force, James Douglas, advanced an official reprimand to Gen. Anderson for telling the American people the simple truth about a non-military scientific project of tremendous international import. It is indeed a sad performance. We do not think Gen. Anderson's statement has been demonstrated in the eyes of the American public because of the poor performance of his superiors.

But this incident is important in reminder to us of the strengths now going in the Pravda to establish a form of censorship aimed at having only the "officially approved" viewpoint of the Defense Department reach the American public.

—Robert Hora

B.F. Goodrich



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WHO'S WHERE

In the Front Office

G. A. Billings, vice president finance and treasurer, Bell & Howell Co., has been elected to the Board of Directors, Calif. **W. B. K. Glenshaw**, senior vice president and treasurer, has been elected to the Board of Directors, Calif. **W. H. G. K. Glenshaw**, senior vice president and treasurer, has been elected to the Board of Directors, Calif. **E. C. Johnson**, director, Defense Research Corp., a division of Goodyear Industries Inc., Menasha, N.J.

J. G. Mohr, a director, Chicago Pneumatic Tool Co., New York, N.Y. Mr. Mohr is president and chief operating officer of the company.

Frank H. Farnham, president, U.S. Airplane Division, Keff Tektronix Center, Inc., Portland, Ore.

Gerald T. Hopkins, vice president, Atlantic Research Corp., Alexandria, Va. Mr. Hopkins continues as manager of operations of the company's research and development division, research and development division, and technical division.

Robert S. Levin, vice president sales, Goodyear, Inc., San Valles, Calif.

Donald W. McMilligan, vice president engineering, and **George F. Paine**, vice president, West Coast operations, Goodyear, Inc., Los Angeles, Calif. **Donald A. Hetherington**, managing director, McMilligan's chief engineer.

Walt Schindler, vice president-engineering, Westinghouse, Pasadena, Calif.

Larry J. Watson, vice president sales, Clevite Industries, Inc., Cleveland, Ohio.

Arno Dreyer & Company, Goodyear, Calif., has announced **Terry Horne**, in charge of the Sales Division, and **John Paul**, vice president of the newly established Materials Reclamation Division.

Tom T. Clegg, vice president to the president, A.M.G.O. Industries, Inc.

Cap. Edward W. Rieke, USN (R), has been assigned Deputy for Naval Aviation, Aircraft Systems Branch, Division of Aviation Development, U.S. Bureau of Naval Personnel, Generation Division, Naval Cap. Rieke has been assigned to Command of the Naval Personnel Division, Bureau of Personnel.

Honors and Elections

Dr. Anthony J. Cope, the head of Goddard Space Flight Center's Instrumentation Group, has been elected to the U.S. Air Force sponsored Committee on Laboratory Services of the National Academy of Sciences, Washington, D.C.

Dr. Walter P. Dohr, director of Lockheed Research Laboratories, has been elected to the Board of the 1915 Electrical Engineering Board, Senior Research, Institute of Studies Engineers. "For contributions to education and for his invention and engineering development in field emission cathodes."

Robert L. Dehaven, administrator, vice president and treasurer of Walter E. Dehaven, Inc., has been elected director of Constellation Foundation, Inc., research arm of the Constellation Institute of America.

Dr. Clifford E. Berry, research director of research for Compton Electrodynamics Corp., has been elected director of the Gordon Research Conference on Infrared Action for 1959.

[Continued on page 51]

INDUSTRY OBSERVER

► Direct radio link between Washington and Paul Hunter, Director, will be provided by Navy's new space-based communications system now being installed. Navy expects to achieve a range of about 10,000 miles by using more than a dozen **Skylab** satellites in a polar orbit. **Skylab** will provide a space station at several elliptical orbits in (NW 13 p. 12). It will employ 54 40-channel links to be made in D-S Kirschner & Co., which will be similar to four employed for radio telephone.

► An Army will soon call for industry bids for development of a bending limited medium range ballistic missile. Contractors selected to bid reportedly include Bell Aircraft, General Electric, Martin and North American, Bell and General Electric and subcontractor - joint Army proposal.

► Complete telephones records from branch to branch will be obtained on the most efficient in the last two to three Akia Storage Record of storage's bentham at least from various recorders to write records to thousands of a second, showing that this system saved 2 1/2 living laboratories. Most recent incident to main purpose of these Akia-bent telephones and main cause exponentially fast production useful information even though they were not received from the sea. USAF and Navy developed telephones to obtain readings on the rear.

► Static testing of Titus engines at Cape Canaveral, Fla., will be done in sequence to simulate under flight of second engine. Larger first stage is placed in tail of two half-scale partners. Immediately and in a second stage in one of the half-scale partners. Stages are electronically connected so that second engine fires after first stage has fired and simulated counting time has elapsed. Blockhouse who is involved, unlike the single-level Akia blockhouse.

► Number of reorganization changes are on the way for General Electric's Defense Electronics Division. Most significant will be the formation of a weapon system management department to enhance GE's ability to get major weapon system contracts and to better integrate efforts of individual defense departments. Responsibility for space vehicles will be assigned to Missile & Guidance System Department, previously building space craft for Atlas and Thor ballistic missiles.

► Navy is evaluating the Sud Alsatia turbine helicopter for possible use of distinction as an anti-submarine warfare weapon. Navy eventually hopes to extend concept of using small helicopter for destruction of submarine targets to other anti-submarine warfare techniques such as that of killing submarine. Turbine could extend a helicopter's present ASW life expectancy of up to ten years. Alsatia is being built in U.S. under license by Reynolds Aviation Corp.

► Guidance system for production model of Navy's Polaris fleet ballistic missile is expected to weigh no more than 100 pounds. It will be designed for already developed land-based intermediate range ballistic missiles. Polaris' guidance is being developed by Massachusetts Institute of Technology and General Electric.

► Polaris test vehicle is dynamically available to provide extreme test of effectiveness of weapon system weapons. Of 12 flights to date, 16 are said to be completely successful, five partially successful and one unsuccessful.

► Solid gasoline reportedly is in an advanced stage of development by the Fed. Institute of the Soviet Academy of Sciences. Liquid gasoline is mixed with plastic pellets to form a thick paste of 95% gasoline which is shaped into bricks. Bricks are wrapped in a special film to prevent evaporation. By way of passing of the solid form of gasoline in its vapor its transportation qualities and safety of explosion. Liquid gasoline may be obtained from the bricks by injecting them to pressure.

THE PLASMA JET— a case of research and advanced development

Development of a re-entry simulation facility for the Air Force's X-15 has once again required a method for heating air to extremely high temperatures. A special type of electrical discharge, sometimes called a "plasma jet," was examined. Both fundamental research—to obtain a quantitative understanding of the air properties and mechanisms—and applied research in aerothermal and materials testing were needed. Advanced development—the actual design and construction of improved test facilities—was also an inherent part of the problem.

Theoretical and experimental physicists, aerodynamicists and physical chemists began a simultaneous attack on the fundamental problem. At the same time, mathematicians and mechanical engineers began to build and use a series of continually improved facilities for re-entry testing. Those inclined toward either fundamental or applied research in their particular specialty were able to maximize their integrity and their own research approach. At the same time they were able to benefit from the close working association with one another.

The results were especially fruitful. The plasma jet has proven an excellent tool for re-entry studies. Investigations of important applications to high-temperature chemistry, space propulsion and reentries are following in an added bonus.

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Washington Roundup

Procurement Studies

House and Senate Armed Services Committees and Defense Department will make comprehensive studies of the military procurement system to pave the way for action on legislation early next year when the new Congress comes in. Major areas of this direction include:

- **Sea Launch Satellite** (Miss.) high ranking Republicans on Senate Armed Services, aided Committee Chairman Sen. Richard Russell (D-Ga.), to direct the staff to make a review and evaluation study on legislation he recently introduced that would expand use of the "seaport system" and develop seaport-type controls and decentralize authority, supervision of research and development contracts (AW Aug. 18, p. 18). He has asked the Senate and the three services committees to have their staffs study the issue. Russell plans to submit recommendations made at a meeting of these studies and recommend revised legislation in January.

- **Staff of the House Armed Services Subcommittee** shortly will complete its investigation of defense procurement practices and will issue a "white paper" containing its findings. The group's chairman, Rep. Edward Holton (D-La.), plans hearings in mid-November. Members of the subcommittee have been antagonistic toward the ongoing review and the extensive use of seaport contracts. The group has urged greater use of formal advertising bid contracting.

Defense Funding

Legislation which is in its original form threatened to trim up new defense funding available by putting both new cost-cutting moves and expenditures for production and research and development on a year-to-year basis was as muted down in the version finally passed by Congress that it is expected to have little of its effect. At least in the White House, the measure provides:

- That **full funding**, as at present, shall be continued for defense production and research and development. In the original version, last-term plans would have required constant funding over a five-year annual congressional appropriation.
- That the **President was informed** and the Congress set an annual ceiling on Defense Department spending. The ceiling is generous. Under the original measure, the first ceiling established in law would have been \$200 billion. Members of House Appropriations Committee emphasized the impracticality of establishing a ceiling a year in advance.

CRAF Negotiations

Air Force Secretary James H. Douglas met with commercial airline officials last week to lay a move to reach an agreement on the proposed standards covering the Civil Reserve Air Fleet (CRAF). No agreement on the terms of the contracts were made during the Pentagon meeting, but with Air Force and the airlines agreed to resume negotiations on Aug. 26.

Until this meeting, little or no action had been taken on the proposed contracts during the past three years, although the airlines have been prepared to turn over the fleet to the Defense Department in the event of an emergency without the benefit of contracts. Last month Stuart C. Toman, president of the Air Transport Assn., charged that the Air Force had failed to act on

the standstill requests despite the fact the airlines have continually shown a desire to work in the issue.

Meanwhile, the ATA has reported that over 70 million passenger miles of airtime were offered for military by the U.S. scheduled airlines in response to an Air Force survey following the Mid-East crisis last month. ATA said that enough air service to the more than 11,000 personnel in Lebanon was offered the Air Force and that the airtime could have been placed onto operation immediately without interrupting regular civilian airtime.

Defense Committee Cut

Defense Department on Sept. 1 will abolish another of its existing committees, cutting the number from 12 to 10. The cut will affect the staff and eliminated 133 employees (AW July 7, p. 25) and deleted from the list by taking that they were deemed not to be joint Department of Defense assignments.

The cuts were made on orders of Defense Secretary Neil H. MacLean in an effort to accelerate the decision-making process within the department. Next week will be review Defense Department representation of inter-departmental and inter-service committees.

Renegotiation Outlook

Congress last week approved act to extend the renegotiation act by six months—in Dec. 31. The House and the Senate Finance Committees voted the six month extension. They also extended the law to include contracts let by the Air, Navy, National Guard and Space Administrations. The White House had wanted a three-month extension of the act.

W. M. McRae, president of Boeing Airplane Co., speaking for Aircraft Industries Assn., told the committee in the law as follows, before House Appropriations Committee (AW Aug. 18, p. 27): Robert Dedman, general counsel of Defense Department, presented the Administration's support for the measure.

Post-Contract Analysis

Air Force is going "serious thought" toward establishing criteria for a post-contract analysis of profits to contractors and cost comparisons, "but they agreed to it at the earliest," according to Lt. Gen. C. S. Irwin, deputy chief of staff for material. The analysis would include an evaluation of management and hand cost, profitability and be used in establishing a firm's eligibility for incentive profits. Gen. Irwin said it might also be used in subsequent review of the contract by other authorities, including the Renegotiation Board.

Controller Reluctancy

Civil Airline Administrators is becoming concerned over the unwillingness of some of its best air traffic control trainees to assume full responsibility. While CAA has avoided public expression of this concern up to now, it is clear that most of the best qualified students have shied away from volunteer to chief operator when it was offered because of the added workload and responsibility. Under present Civil Service criteria, they say, this emphasizes the problem of filling top controller jobs, since the assistant operator can elect to remain at the lower grade while blocking other aspirants.

—Washington staff



TECHNICIANS wait outside Vanguard second stage prior to mating it with first stage. That (below) is first lower probe that At left complete vehicle leaves launch pad.



VANGUARD second stage showing Aerogel General liquid propellant engine is linked with the primary stage at left. Second and third stages are joined at right.



First U.S. Lunar Probe Fails

By Everett Clark

Cape Canaveral, Fla.—First U.S. lunar probe test vehicle had exceeded a difficult roll and burn and was performing perfectly, but work went on to separate the upper stage because of an explosion that ripped apart the Thor first stage engine after 77 sec. of flight.

Despite the early failure, engineers on the project took some satisfaction from their points:

- Different task of launching a liquid fueled rocket precisely at a time set under such strictures was always addressed.
- Forget time was 7:14 EST Aug. 17. Launch time was 7:48 EST, and the few seconds delay was caused by failure to receive instructions from Headquarters, from the Space and Missile Test Center.
- Roll programmed into the flight and successfully exceeded six of greater magnitude than any so far on a Thor Able shot. Telemetry data indicated that the control system, in which some changes had been made since the last previous flight, worked well.

- Telemetry records confirm that the flight was going perfectly until the explosion. Maj. Gen. Russell A. Johnson, commander of Air Research and Development Command's Ballistic Missile Division, and unashamedly also a Thor Able, "everything was perfect up to that point."

USAF's plan to attempt a second lower probe launching on the first day passed beginning Sept. 14. That first

stage already is at Cape Canaveral. The head of the Project justified that model attempt to orbit around the moon would probably be the size as that used in the first try.

Explosion occurred at approximately 10,000 ft and approximately 10 mi at sea exactly 77 sec. after launch, or 30 sec. short of burnout of Thor's Rocketdyne engine. Suspected cause of failure was a ruptured JP fuel or liquid oxygen line.

By law last week only pieces of test stage and skin had been recovered by divers. Upper stages have been recovered, although broken. Kraft's telemetry signals from upper stages and payload were good for approximately 121 sec. after the explosion, and upper stages were tracked all the way to impact with the ocean.

The Rocketdyne engine, first of the production line at the Neosho, Mo., plant, was not static tested at Cape Canaveral. Neither were the first stage engines in the last two of the three Thor Able shots that preceded the lunar vehicle. Lunar vehicle was designated Able I.

Schweier said a ruptured fuel or liquid oxygen line would be considered a major failure but could not have been predicted. Static testing might not have predicted the same failure, but the type of actual flight fuel and also weight has a varied effect on damage. Rocketdyne polymers and Nextel fabric also will use a Neosho engine.

After Promising Launch

The 35-ton Able I was launched at an angle of approximately 221 deg north of the equator, the most northerly angle for an orbiting along the Africane Missile Range except for the recent launching of Explorer IV at 21 deg.

Even the achievement of low flight was considered a success. Douglas, which met the first stage, said it had 13 sec. useful flight on its Vanguard Secondary, and the regass are to instantize one of the last seven launches, which reflected the Thor-Able data.

The 7,300-lb thrust Aerogel-Central

second stage engine has been fired in flight four times in the Vanguard satellite vehicles and has been used in the second stage in the other Thor Able. In at least two of the Thor Able it performed perfectly.

In the Vanguard, the Aerogel engine, a creation by Naval, with three successful firings, was used. On one, the first, it performed successfully. On another, it did the same but two electrical relays failed, and the third stage was not ignited to fire. On another, one of the two igniters failed, putting the vehicle out of flight on an仰推 angle for an orbit. On the fourth, the engine cut off prematurely and terminated the flight.

Schweier said the control system for this stage has been "changed very considerably" from the Vanguard configuration.

Allegro, Ballistic Laboratory's 7,300-lb thrust third stage engine for Able II never had been used in flight but has been static tested at Arnold Engineering Development Center. Third stage engine, a 7,000-lb thrust rocket surrounded by the model payload, was not pointed upward at the time of launch, as a Thorlek engine similar to those in the Falcon missile.

If the vehicle had performed as normally, both the second stage and eighth spin rockets were to fire simultaneously after separation of the first stage. After the second stage burned and separated, an activation ring rotating the third stage payload was to drop



RETROROCKET is visible in top of uppermost stage package. Eight upper rockets for terminal velocity and entry control are attached at the base. Instrumentation visible inside includes TV cameras.

THOR-ABLE rocket exploded shortly after the base launch at Cape Canaveral. Vert. cell strike and white debris are pieces of underwing fairing from the explotion.



SPACE AGE BAWN—Liquid oxygen vents from Thor Able I lunar probe vehicle at lifting time from Cape Canaveral, Fla.

Soviet Moon Shots

Washington—Soviet Russia has failed at four or five attempts to send rockets to the moon. One rocket contained a nuclear warhead and was intended for a direct strike on the moon's surface.

Russia's most recent failure reported by Aviation Week last Aug. 4 (p.26) apparently was the fourth attempt.

First Russian shot, containing the nuclear warhead, was fired last year shortly after Sputnik I was placed into orbit. Attempts were to be made also to photograph the nuclear explosion on the moon for propaganda purposes.

Shots occurred fairly regularly after that. One was made only on January, another in March, another on May 8 and the last is July.

Some of the later shots may have been of the orbital type similar to that attempted unsuccessfully by the U. S. on Aug. 17. These require long periods of time to photograph the moon.

Strong criticism by scientists of proposals to explode nuclear weapons on the moon's surface may have convinced Soviet leaders that the propaganda has suffered such a setback that it would be greater than the cost.

U. S. Agency finds moon shot attempt, due later this year, will be as rugged but not well set article on explosives.

Third stage was to burn and then wait while readings were taken on velocity and direction for a period of five or six minutes. Then, several pairs of rocket nozzles were to be used in an attempt to improve the velocity reading.

The Thorbie payload case, weighing 81 lbs, also contained a radio receiver which would have received a signal from a tracking station at Hilo, Hawaii, fired the terminal rocket at 280,000 ft. from earth in an attempt to put it near enough to the moon that it would be pulled into some kind of orbit. Series of orbital orbits might have lasted up to a week. Classical batteaux in the running satellite would have lasted approximately two weeks.

Payload Package

Payload package contained:

- Instruments for measuring temperature, radioactivity, and the motion of high and low energies.
- Instruments for measuring astronomical impact, internal temperature of the whole case and chamber pressure of the terminal rocket to indicate whether it fired.
- Internal-telemetry sensors to obtain crude pictures of the moon's surface.
- Batteries and telemetry equipment for broadcasting on 108.63 mc, the International Geophysical Year frequency.

Determination of whether the case

had a magnetic field probably will be more important than obtaining pictures of the moon's far side which is expected to look like the side that always faces the earth. Theory of the cause of earth's magnetic field may be clarified by investigation of magnetic fields that may not be the same or different from the moon's.

Leading off at 8:15, the two remaining USARP moon probes to operate. Mora is under the direction of Defense Department's Advanced Research Projects Agency Program is untroubled in USAF's Ballistic Missile Division. Space Technology Laboratories of Thompson Ramo Wooldridge Corp. is the prime contractor. The probes are on an XGY program.

Space Technology Laboratories, soon to become a separate organization (see page 24), handles overall industrial direction and systems engineering, development of components and subsystems for the second and third stages and the payload. It also supervises establishment of the tracking network and handled data reduction.

Fifths are industrial and scientific tracking network complete the network. Mora station sends "quick-link" data to 8810 STL's data reduction center at Ingleside, Calif., by teletype and short telewriter data on magnetic tape.

Space Technology Laboratories' project director is Dr. George E. Mueller. DMD project director is Col. D. R. Lathem. For the first launch, test director was Miles Rans of STL, test controller was Ted Gordon of Douglas and test controller for DMD was Capt. David G. Geffen, project officer for the complete Able program.

Space Technology

Gen. Irvine Details Guidelines For Contractors in Space Age

Soft-Lake City—Ability to produce low-cost hardware with high performance and reliability will begin defining the contractor's will being of industrial relevance compared to the Air Force, Gen. George S. Irvine, director of the Defense Department's Defense Systems Division, told the meeting.

The warning that industry must become increasingly competitive and cost conscious was delivered by Lt. Gen. Clarence S. Irvine, deputy USARP chief of staff for material, at the dedication of a new Lettice Industries facility here.

Irvine added:

"In the past, we have used such techniques as failure feedback, report failure to be erratic programs to make up for shortcomings in reliability and durability. These procedures worked fairly well with long production runs—although in the end they were usually discarded."

In the future, however, short production runs will be the norm, he said, and such corrections will be totally unacceptable. This means that failure-to-mission performance capability must be designed, developed and produced with first and subsequent items. We cannot waste time and money building complete prototypes of complete weapon systems just to prove out the accuracy of our early analysis calculations."

"Functional reliability and structural durability should be virtually 100% if requirements and parts control provide performance above minimum specified in the most severe condition, they still be considered as not being reliable."

Gen. Irvine also emphasized that "it takes time" over time the performance of an electronic component or system can improve "pace staggered" or too often at a degradational rate.

"The point is," he added, "the Air Force is going to be more and more cost conscious as we move into the space age. Neither completion of equipment nor international training practice existent pricing patterns."

The industry as a whole can take this point very seriously. The dollar criterion will be applied more and more as a measuring device in awarding development and production contracts."

Gen. Irvine and program personnel will continue to be selectively lower percentages than in the past. This means, he said, that industry will be forced to use that reliability, delivery and billings or more current and more accurate than at present in order to avoid excessive hoarding of capital at commercial interest rates.

Ramo-Wooldridge to Sever Ties With Space Technology Division

Los Angeles—Ramo-Wooldridge Corp. has moved to sever all commercial relationships with its former Space Technology Laboratory division with the announcement that Gen. Jesus H. Double, well-known Board Chairman of the letter on Jan. 8 that all Ramo-Wooldridge representatives on the board of directors will be withdrawn shortly afterwards.

However, Ramo-Wooldridge and Thompson Products, with which it plans to merge (AVW July 28) retain full ownership of Space Technology Laboratories and have no plans to divest any of these holdings, an official said.

Space Technology Laboratories serves as Ramo's technical consultant to the Air Force in its ballistic missile program and in real space technology projects, including the lunar probe program.

Dr. Steven B. Ross, president of Space Technology Laboratories, will return to his former post as executive vice president of Ramo-Wooldridge after a short transition period. He will be succeeded as president by Dr. Louis Dorn, currently executive vice president and general manager of Space Technology Laboratories. Robert Mettke will succeed Dorn as executive vice president

present ram total about \$48 million.

Company will employ around 2,500, including approximately 900 engineers and scientists. This will leave Ramo Wooldridge with total employment of around 1,500, including approximately 600 engineers and scientists.

Space Technology Laboratories will not be operating as a profit-oriented corporation, but as a wholly-owned subsidiary of the rest of the Air Force and Ramo-Wooldridge, its director, SLL's technical management offices, those Ramo Wooldridge's own offices, the management will be. Under the original terms of the Air Force contract, Ramo-Wooldridge was excluded from participating in a modification in any of the USAF ballistic missile programs in which it was serving as a technical adviser.

The latest move follows earlier partial steps which saw Space Technology Laboratories modified first as a separate division, later as a separate organization, but with Ramo-Wooldridge representatives on its board of directors. Under the new arrangement, Ramo Wooldridge and Thompson Products will merge their financial data on SLL operations as the sole stockholders but will not have access to non-financial data, a Ramo-Wooldridge official says.

At a separate corporation, Space Technology Laboratories will have total assets of around \$23 million, net assets of about \$12 million. Annual revenue it

will be substantially reduced by the lack of business. USAF's excess markets, the contractor said, are being used "for proficiency training with dummy heads." USAF's contract for the 15-round launcher is with Centec Corp., St. Louis, Mo., Navy's with the Bell Co., Glendale, Calif.

The contractor concluded that the Air Force could have brought forward the date of an evaluated working model to the same seven-round launcher model as the Navy's and Air Force's, by quickly augmenting its inventory of unproduced launchers."

The report, which is based on a two-year investigation of the launcher program, said:

"Centec Industries declined shelf study and selling its unique special production. In several meetings between company and Air Force representatives, prior terms, anticipated delivery dates, national supply factors, and other criteria were discussed. The Air Force did not follow through on its negotiations and Centec Industries went out of business."

In reporting Centec Industries' shift and declining to develop production, the contractor's spokesman explained the risk of an organization which the supply of launchers would be severely limited.

Navy's reason for switching from the seven-round to the 15-round launcher is under to achieve "the long-sought goal of inter-service compatibility of aircrew rocket launcher," was challenged.

"While the suspension systems of aircraft in both services can be used

interchangeably to mount the 19-round, the contractor declared, "other design modifications make the Navy launcher unsuitable for the Air Force."

The contractor added that "an expensive adaptive device designed

for Centec's launcher and costing less than \$50,000 could have been used to make the same seven-round launcher usable by both Navy and Air Force aircraft."

After the decision, the report said, the launcher went from 47,750 in January, 1971, to 28,787 in March, 1978. By

though only a third of the 44,261 launchers the Navy ordered in June 1978, has been delivered, the contractor reported that Navy witnesses speaking in the same year at the Air Force, declared that changing tactical requirements made this attitude disastrous, reprehensible. They also said that the number of planes using this equipment has been reduced."

De Havilland Designs Dual Spectre Rocket

London—De Havilland Engines Co. Ltd. has developed a double Spectre liquid propellant rocket motor combining a fast-burn Spectre + and a second stage Spectre 2000, mounted above a variable thrust three-burn 5-mot. Development of the nozzle and a manned intercepter propulsive revolution has been proceeding since late last year the engine's engine has closed.

At both rocket burns have been reportedly developed over the last few

years, the combustion posed no special problems and passed a special oxygen flow test a few months after the design was completed.

Both Spectre can be brought into play quickly to full thrust and either may be shut down. The variable thrust unit may be fired separately. The arrangement provides a controlled variable thrust range between the rolling output of the variable unit up to the maximum thrust.

Alternatively, the fixed thrust motor can be operated at its maximum setting, combined with one setting of the variable thrust engine.

Combination of two developed units in this way has led to an acceptable powerplant with long life in a much shorter time than would have been required in designing a comparable engine from scratch, De Havilland said.

Upper and lower nozzles are virtually independent units carried from a common tube, front and integral nozzle to eliminate the wiring involved when operated with a differential thrust.

Assessment of the two units shows that the thrust lines intersect at the center of gravity of the installation required.

Only dependence between the two units is the need to start the variable unit first, as this unit contains the power source of the upper engine until the lower motor is self-sustaining speed.

Both rocket engines have hydrogen peroxide in the oxidizer with liquefied air fuel.



Northrop Rolls Out Area-Ruled T-38 Supersonic Trainer

Northrop Aircraft, Inc., has rolled out its first USAF T-38 supersonic jet trainer (see data sheet at sidebar) at Hawthorne, Calif., plant. Assembled front, which will be evaluated by Air Training Command, is powered by two General Electric J85 turbojet engines producing 2,950 lb. thrust each. Air version of T-38 is designed to permit engine removal, rear and removal, each engine has checklist task and other arrangement to facilitate loading. Controls are hydraulically powered. Designers have stressed maintainability (AVW July 18, p. 11) and safety. Northrop N156F fighter is under parallel development.



one and done for spectrometer calibration, the results will probably dominate only discussions rather than technical considerations.

Quantumtron's scale meager and somewhat erratic, the effect of various sulfur sulfur impurities becomes 100 mV and 2,000 mV desulfur. Figures can below 10 mV are subject to a high level of auto-ions desulfurization as well as being strongly affected by the temperature. For temperatures higher than 2,000 mV, auto-ions become gas bound rather than ionized and desulfurization through the temperature is heavily attenuated in water vapor, probably beyond 2,000 mV.

None of the results can be correlated to any power demands of the temperature or the number of the auto-ions or the number of the ionizing bonds. Values of Moles desulfurization is limited by the fact that they do not reflect temperature, low frequencies below 1,000 mV exceed Moles's same saturation capabilities.

Because repeat noise reduction by cutting densities is limited by the desired rate of desulfurization flow. In some early noise probes, it may be reasonable to compromise, but for the sake of low noise levels. One in 10 nuclei per second would probably be adequate. Telephone requires 100 cps, voice transmission requires 3,000 cps and jet aircraft transmission requires three megahertz.

Weight factor, the ratio of energy available as weight, chemical storage and radioactivity into metric points is a central problem. Key factor is the ratio of power to weight of the possible material.

Weight factor for different sources listed by Hinsel:

- Solar batteries—1 watt per pound
- Chemical batteries—45 watt hours per pound

• Atomic batteries—700 watt-hours per pound

• Energy cells—500 watt-hours per pound

• Thermocouples

These are direct current voltage sources of conversion to make the species as a supply about 10% and may be as high as 10% below 100 mV.

Continuous communication with space vessels or lunar landing parties can be made possible only by establishing an earth of between four to eight stations at approximately equidistant points in an elliptical orbit.

Athens' spokesman of minimum transmission by rocket exhaust gases is no more than a few desulfur. If auto-ions is limited in the noise but may be 100 times greater if the auto-ions is limited to the noise east, according to R. I. Schatzman of Lockheed Missile Systems Division.

Describing the mechanism of noise attenuation, he said that 80 dB signal at 100 mV due to free electron-hole recombination. Passage of an electric discharge wave from the antenna accelerates electrons to a velocity several hundred times greater than that of the heavier molecules in the combustion gases, of which one of the most intense is water. This effect increases collision frequency and part of the energy received by the electrons from the wave is transferred to the molecules in the air.

Molinda water has the largest collision cross section of any of the substances in the flame. It is also lighter than most of the other insulation products and defines more rapidly, from the exhaust jet to cut a wider Market between insulator and insulator. The electromagnetic wave suffers some change of phase and reflection as well as absorption during its passage through the flame.

+ Marquardt Aircraft Co. sales for a 12 week period ending July 19 totaled \$23,310,000 compared with \$19,951,000 last year. Net earnings of the company rose from \$10,600 to \$470,000.

News Digest

Pratt & Whitney J38 Mach 3 plus turboprop for the Navy has successfully completed a 900 hour test program for the company. Only an unusual high power demand was the first to exceed the test limit.

Atmospheric test of the aircraft is planned for the end of the month. The aircraft is believed to be the single speed, 30,000 lb. thrust class aircraft being considered at the new Pratt & Whitney Research and Development Center at West Palm Beach, Fla.

Fairchild Aircraft, Inc., Ill. flew for the first time last week. New version of the turboprop ASW aircraft features anti-icing wing panels and tail of Convair design. Propulsion is believed to be an Armstrong Siddeley Double Marlin ASMs.

Handley Page obtained private landing of a medium size jet transport aircraft in the London area and drag tested the HP 113. Two Bristol Orpheus turboprop tail mounted will be the powerplants.

Engineers Plan Strike

New York—Eastern Air Lines flight engineers last week definitely planned to strike following a decision by the air line that it would accept a fuel loading limit's recommendations for photograde fuel engines.

The transcribed emergency board's report was made July 21 (AWW July 26, p. 12) and the 30-day period for protest against the proposal of midnight last Wednesday. The strike now is due to start.

Negotiations over the long-debated cost control between Eastern and flight engineers' green' International Assoc. continued until late last Wednesday and last less began drawing in wage questions even before the airline's announcement. Some 600 engineers in the Eastern chapter of IFEA are involved.

The 750 FEAs members in the Pan American Airways' company last week also voted to give the union the authority to strike if the airline ever negotiates with Air Transport Assoc. on the third tier rates. Similar strike action among other airlines with PATA members are likely, the engineers said.

• Korean Air Lines reported sales and earnings gains. First half sales this year were \$9,616,473 and earnings \$167,147 compared with \$7,179,800 and \$145,520 last year. Increased sales and a better earnings rate were forecast for the second half.

AIR TRANSPORT

Airline Profits May Drop to '49 Low

Net profits of trunkline industry for first six months of this year fall 76% below 1957 level.

By L. L. Doty

Washington—A decided slow-down in the known gross profit of the domestic trunkline industry during the first half of 1958 threatens to lower net earnings for the year to their lowest level since 1949.

During the first six months of 1958, net profits of the trunkline industry, including gains from the sale of aging aircraft, were \$100 million, down \$30 million from the level reached in the immediately past. With passenger traffic holding for an apparent plateau plus a continuing increase in available seat miles, prospects for an improved profit picture during the balance of the year are poor.

Sentiment of Flight

Sentiment of the current industry's profit is best reflected by the falling load factor of the 12 domestic trunklines. Load factor for the year ending July dropped to an eight-year low of 59.18%, a 3.46% decline below the same period of last year.

With realization of load factor in operating profits has been undertaken by the Air Transport Assoc. As in its joint flight with the Civil Aerobatics Bureau in the General Passenger Rate investigation.

In this case, the ATA emphasized that substantial declines in operating profits will result from a drop of even one point in the load factor. For example, the group pointed out that a one point drop in 1955 load factor would have cut \$17.8 million off the industry's \$81 million operating profit that year.

These industry leaders hold out little hope of assisting the current load factor to a loadline level during the balance of the year. Available seat miles continue to rise, although the rate of climb has been easing substantially to its five year low.

Nevertheless, the increase seems unbroken up 8.5% in July, 9.7% in June. With the new turboprop equipment made to cover off the production line coupled with the growing problem of dispensing of old equipment there appears to be little chance of arresting the upward trend.

Meanwhile, revenue passenger miles for the 12 months ending in July fell

to 24.59 billion, the lowest level for this year and a 15% dip below last year's figure.

There also is a dangerous slack in traffic volume being handled by the 12 trunklines. During the first six months of 1958, tonnage is lower than aircraft en route for the year to their lowest level since 1949.

During the first six months of 1958, net profits of the trunkline industry, including gains from the sale of aging aircraft, were \$100 million, down \$30 million from the level reached in the immediately past. With passenger traffic holding for an apparent plateau plus a continuing increase in available seat miles, prospects for an improved profit picture during the balance of the year are poor.

At the traffic rate, total number of passengers carried for the year will fail to show the spectacular annual in excess recorded since World War II and may even fall short of last year's record. The industry carried 463 million passengers in 1957 against 517.6 million the previous year and 345 million in 1955.

Why the Square

Most industry spokesman were quick to attribute the declining traffic picture to the 1958 recession and the two major conflicts this year. The profit squeeze was laid directly to an unprofitable rising cost level which, they said, was rapidly outstripping improved operating revenues.

Eastern Airlines' chairman stressed their steady decline for the first six months of the year with only Eastern Air Lines as posting any increase in holding costs below those of last year. With the exception of Western Air Lines, which suffered a three month pilot strike during the first half of the year, operating revenues showed substantial increases.

In most cases, the revenue jump was attributed to the recent passenger fare increase granted the airline by the CAB on Feb. 28.

Airport Aid

Washington—Congress last week approved legislation increasing federal aid for airport construction from \$65 million to \$100 million a year. It would extend authorization for the program by five years to 1963. The House then voted a provision for a \$75 million "emergency fund" to catch up on the backlog of airport projects cited by the Senate, and the Senate went along with the House action.

For example, Eastern reported a 15% decline in revenue passenger miles in the seventh period and a 4% decline in the number of passenger carried but showed a 12% increase in total operating revenues. The airline president, Thomas T. Armstrong, pointed out that the six month average of Eastern reflected a \$7,661,000 gain after taxes from the 10% plus 5% per ticket fare increase.

Generally, the industry continued to fall as additional bums in the fare base as a means of seeking profits from the economic pinch. However, more than a dozen officials continued to vary widely in sending, in the light of the just six month situation, whether traffic would bear further fare boosts.

Coach vs. First Class

Traffic expansion, during the first six months of the year, was confined almost entirely to coach traffic with first class traffic showing a consistent decline over the same period. The trend indicates, to some degree, that passengers are now seeking, in growing numbers, bargain prices rather than luxury services.

As a result, evidence came from traffic trends during the past six months to indicate that, when revenue passenger traffic increased by a few percent, it does not necessarily follow that the overall 10% annual increase in passenger volume will be matched if fares are raised.

An unusual case is that of the experience of Northeast Airlines thus far this year. The airline's tourist class traffic jumped from 587,000 during the first six months of 1957 to 563,000 for the same period of this year. First class traffic dropped from \$4.1 million in the 1957 period to \$3.7 million in the first six months of this year.

The trend has been even more evident on North Atlantic routes. International Air Transport Assoc. last week reported that more economy flights were undertaken on the North Atlantic in April of this year, the new low fare service, less accounted for 59.0% of all revenue passengers carried during April. May and June with 49.4% holding constant and only 21.8% flying first class. However, airline leaders agree that, if a higher fare is forced to be the case of a flight, it will be an easy enough matter to adjust fares downward in order to meet all of the demands of traffic potential. They

Curtiss Ends Studebaker Alliance

New York—Curtiss-Wright Corp. last week terminated its connection with Studebaker-Packard Corp., dropping all options to buy the aircraft Studebaker-Packard had and ending its management agreement originally scheduled to run another year.

The increasingly diversified Curtiss-Wright Corp. will buy another \$2 million, the two plants at South Bend, Ind. and Akron, Mich. It is said that Studebaker-Packard had \$75 million and will get full payment of an American subsidiary of the German aircraft and motor company of Daimler-Benz. This will give Curtiss-Wright the right to manufacture the German firm's diesel engines and other products.

When the Studebaker-Packard agreement was made, Curtiss-Wright's general manager Development Corp.

claim that airlines will take such action voluntarily and add that this is the only logical method of assuring future safety and cost reductions.

The major industry will be forced to act quickly if traffic trends lead off since all future plans are based on a conservative of the traditional growth pattern. Falling load factors, excessive seat miles and less utilization will result from a traffic decline and will surely be a concern stemming from the introduction of larger and faster jet aircraft.

Forecasting of traffic is a delicate science at best and most airlines turn to the conservative side in making predictions on which to base expansion plans.

Nevertheless, most forecasts vary widely. In a recent study, the International Civil Aviation Organization said that, during the past five years, forecasts made by "the major load basis" on U.S. domestic aircraft produced the following five results for the year 1965: 867.7 billion of passenger miles, 24.8, 27, 45 and 52.5.

The same report forecast a 15% annual traffic increase from 1965 to 1968 but warned: "We caution that these will be the best forecasts available since this growth rate cannot be expected to continue indefinitely, and it will probably begin to fall off when it is no longer possible to introduce traffic stimulants such as cheaper fares and

convenient fares, improved speeds and comfort, new routes or services or more convenient schedules."

In the report the group had this to say: "One of the long-range hazards is aeronautics equivalent to three of the West's present-day major jet aircraft."

This new problem of excess capacity versus a limited traffic potential was raised in the recent report prepared by Dr. Paul W. Cherrington for National Jet Airliner Edward O'Connell. On this point, Dr. Cherrington said: "Airlines have to be more cautious than ever in their expansion plans, considering the costs of the expansion."

"On balance, it must be considered that, while the equipment program can not be determined in environmental data, there is at least room for doubt that the excess traffic can be generated to make enlarged capacity economically sound. Carrier loadability could be given the current traffic forecast if there could be, the new classes or types of customers who they believe will provide the almost doubled volume of the DC-10."

It seems certain that such traffic increases will be forthcoming only with extensive efforts to the citizens on the front of researching new markets and developing programs to move them. Considerable work and expenserevaluation is called for by the carrier to price their new volume in a realistic manner."

Civil Aeronautics Board Raps CAA in Las Vegas Crash Report

By Robert H. Cook

Washington—Failure of the Civil Aeronautics Administration to act on earlier more severe reports in the Las Vegas area was a major cause behind the April 21 widow collision between a United Air Lines L-1011 and an Air Force F-100D, the Civil Aeronautics Board ruled last week.

While criticizing military jet performance of the heavily traveled airways surrounding Las Vegas, the Board was particularly critical of CAA failure to more fully implement or enforce the "no fly" flight operating standard, the "one can't be sure" principle, which started 49 years and resulted in strong congressional demands for tighter rules on air space (AVW April 28, p. 40).

At the same time, the CAA gave credit that it does not intend to drop the fundamental principle for VFR flights on grounds that any existing alterations, such as full positive control, could result in the grounding of a new series of current air operations.

Comments have, reported speeds and conduct two routes in service or more convenient schedules."

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versus a limited traffic potential was raised in the recent report prepared by Dr. Paul W. Cherrington for National Jet Airliner Edward O'Connell. On this point, Dr. Cherrington said: "Airlines have to be more cautious than ever in their expansion plans, considering the costs of the expansion."

"On balance, it must be considered that, while the equipment program can not be determined in environmental data, there is at least room for doubt that the excess traffic can be generated to make enlarged capacity economically sound. Carrier loadability could be given the current traffic forecast if there could be, the new classes or types of customers who they believe will provide the almost doubled volume of the DC-10."

It seems certain that such traffic increases will be forthcoming only with extensive efforts to the citizens on the front of researching new markets and developing programs to move them. Considerable work and expenserevaluation is called for by the carrier to price their new volume in a realistic manner."

Center, McCarran International of Las Vegas and Nellis AFB.

Washington—Civil Aeronautics Ad- ministration case ended congressional fire last week following completion of a study of the agency's functions.

The airbus and it later legal action were complaints from the agency to the CAA but never obtained any action.

Emphasizing that the Civil Aeronautics Administration, by its own admission, was aware of the intent and nature of the Nellis training program and the potential hazard to the public, the subcommittee, between written and oral testimony, gave the agency "unusually strong credit" in failing to take "any action" with respect to the hazardous conditions, even though it was "reasonable to expect" that it should have done so.

Pointing out the CAA's delayed data to relate to accidents in a manner to encourage its development and safety, the Board said, "We do not feel this was done in this case," explaining that CAA made no attempt to reach a voluntary solution in the first 10 days following the accident with the military after which it filed several complaints. Such action was not taken until after the accident when a joint CAA-military safety team was formed to review military safety activities throughout the country and to recommend any air punctuation procedures at Nellis AFB, the Board members pointed out.

CAA Statement

Stating that many of the actions initiated by the CAA and Nellis following the accident could "reasonably have been taken before it occurred," the CAA and that unit's complaints, when reviewed in conjunction with the other findings, should have been filed for use should have founded the inspection in some of the later stages. While United claimed the jet performed, the Board said it did not believe the airline should have suggested that the KRAM punctuation procedure would be used regularly and frequently as a VFR training maneuver.

Citing the use of the staff of safety technicians employed by the CAA and the working knowledge of aviation safety enjoyed by the administrator, James Pyle, the report also stated the failure of Pyle to report the hazard conditions to the CAA in the Las Vegas area. The Board explained that while the administrator is aware of such a condition, but is not able to act, he is required to bring the situation to the attention of the CAA under Section 861 of the Civil Aeronautics Act.

House Unit Criticizes CAA Procedures

Washington—Civil Aeronautics Ad- ministration case ended congressional fire last week following completion of a study of the agency's functions.

In a report of its findings, a House Government Operations Subcommittee headed by Rep. John A. Blatnik (D-Minn.), urged the CAA to immediately adopt these recommendations:

• Accelerate a current study to segregate military and civilian air traffic, and the CAA's current study of traffic volumes and flight patterns of military aircraft should "be given high priority" since two recent causal or near-causal collisions between military jet aircraft and civil aircraft. CAA also was criticized last week by the Civil Aeronautics Board for failing to act on "near miss" reports. CAA has been mentioned in a Board report on its investigation of the April 21 collision between a United Air Lines DC-10 and an Air Force F-100D over Las Vegas last year.

• Consider revising planned cockpit visibility standards. In light of the CAA's failure to take action, the Board said it will continue for an unpublicized time as part of the air traffic control system, the subcommittee said. Study of its effects requires "concentrated effort without delay," as a "matter of supreme importance." Members also had found signs of heated cockpit visibility by the Air Force Assistant Inspector Board in the Brunswick, Md., mission and experiments with luminous paint point up the importance of cockpit visibility.

• Immediately begin a re-evaluation of restricted areas of space. Department of Defense air space claims have been proved efforts to obtain and gain the report and the Board added that such data could be used by CAA for a publication if requested in some cases would enable the agency to deal with the problem on an overall rather than a "piece meal" basis.

• Review mission length standards to handle operational jets. Comparative numbers and their recognition that changes in weight and range for jet strength during the past two years made it difficult for the CAA to determine definitely review length needed but added that the agency could have made some recommendations earlier than the present day without being criticized.

• Encourage communications with air port operators to aid in airport planning. Following complaints by airport operators that first the Board, and then the CAA, was granted free CAA permission at the beginning the subcommittee characterized the situation a "glaring waste."

now in CAA operation." Describing "new and better" better practices, the report asserted the administration also endorsed CAA for net performance criteria for airport operations. • Prompt action to resolve aeronautics law conflicts pertaining to air traffic control. The subcommittee cited the fact, an agreement between the Civil Service Commission and the Civil Aeronautics Administration on job standards for controllers as an example of "poor administration."

CAA testimony that controllers were entitled to take regular breaks and non

periodic breaks of the nature of those which controllers take to maintain station would probably addressees addressed as well as conflict with the agency's "obligation to the airspace," also was described by the subcommittee.

In report observed that "as a matter of operating efficiency, it would seem obvious that the failure of each personnel to participate in what ever other calling either for granted, and the resultant effect on their mental and physical health, could impair the efficiency of the air traffic control system."

PanAm's 707 Begins N.Y.-San Juan Trials

New York—Pan American World Airways' first converted Boeing 707-320 was scheduled to arrive at Honolulu last Saturday and to begin its New York-Puerto Rico service today. Civil Aeronautics Administration on Aug. 15 granted the 707-320 series a provisional type certificate allowing the jet time parts to be operated on training and cargo and other non revenue flights. Full type certificate is expected soon after data from the completed flight test program has been processed.

The PanAm hoped to commence transoceanic flights in November. Northwest, British Caledonian Airways Corp., Canadian, British, South African and BOAC will begin August 4 service to the North Atlantic in early December. The de Havilland jet will be operated exclusively on defense service at the start, stepped up to dual route shortly thereafter. South African and, in May 1970, the airline will go into London-Hong Kong-Taiwan service on a four times weekly basis.

The PanAm took delivery of its first 707-320, actually the first production aircraft at Seattle on the date of its preliminary certification. A second aircraft is anticipated for Sept. 19 delivery and is set Oct. 25.

The first airtanker was expected to fly from Seattle to Miami last week and then proceed to San Juan. It was to leave San Juan Aug. 25 and arrive at New York the same day.

Pyle Rebuttal

Washington—Civil Aeronautics Administrator James T. Pyle last week said the Civil Aeronautics Board erred in the type of flight procedures which resulted in the Las Vegas air traffic collision between a United Air Lines jet and a military jet.

Replying to CAA charges placing most of the blame for the accident on failure of the CAA to set or enforce minimum standards of safety, Pyle said the Board had failed to grant CAA sufficient legislative power to compel the different kind of operation that the CAA had authorized, thus forcing my charge deserved special attention before its issue.

According, Board officials that controller errors between the two aircraft should have been accomplished earlier. Pyle said the CAA was not acting to make the industry concessions necessary to achieve minimum safety and safety in the Las Vegas airway and a later major collision at Indianapolis, Ind., between a Capital Airlines Vickers and an Air National Guard T-33.

Insistence of the CAA to act effectively in the Las Vegas case, he said, stemmed from the "baseless conduct between which which had contributed to prevent these accidents." Pyle stated that certain of the Federal Aviation Agency would eliminate the need to rely on voluntary agreements between air space users to maintain collision hazards.

Leasing Studied as Jet Finance Solution

By Glenn Garvin

New York—As much as \$100 million in capital may be channeled into aircraft leasing plans in the next few years as an investment opportunity that's offering the return and safety way out of those pit financing problems.

Concerned that large-scale jet or lease-purchase arrangements over years may provide the best return in the cargo money market, Amusement Credit Corp., a subsidiary of Financial Credit Corp., is discussing several plans with the industry.

Magnitude of the current need for capital to meet these equipment needs was pointed up in the recent *Chesapeake Report to Financial Air-Subsidiary Leasing Groups* (AW Aug. 16, p. 20). According to the report, \$700 million in financing was required but not yet arranged as of April, 1955.

Difficulty in raising sources of raising capital at normal interest rates and terms, if at all, under present conditions in the industry already had led to some aircraft and equipment in an aircraft export division, Amusement Credit Corp. is looking at a \$100 million capital investment by leasing out a lease arrangement for three types of turbine engines, letting a U.S. partner do the ownership of equipment (AW Aug. 6, p. 35).

Problem Areas

Edward N. Townsend, Jr., recently appointed an Intermediate Credit vice president to handle the new activity, is seeking an area where he believes the main problem lies within the industry.

• **Failure of new equipment** to the total market. This includes aircraft, engines, parts and ground equipment. Cessna would evaluate purchase of their own equipment, with intermediate providing the money, retaining title, and leasing the equipment to the owner as a long-term deal. Lease-purchase plans also are contemplated.

• **Rental terms and economic equipment.** These options will be offered as a "pays by the hour" proposal under which they would pay for the use and maintenance required by the flight hour. Aircraft lessors who will be able to these plans.

• **Used aircraft disposal.** One plan developed by Intermediate involves purchase by the lessor company of an owner's obsolescent aircraft, which are leased back to the owner until replaced by new equipment.

Intermediate has already established "leasing arrangements" with various banks and insurance companies to pro-

vide capital for the lease programs, according to Townsend. In addition, his own company has contracts in a number of banks and insurance firms and can be expected. Townsend said, to participate when his own credit elsewhere to the extent of 10-20% of the total capital of the plan.

The Intermediate official feels that there is a long-term basis for the new activity and that the field has linked an organization with sufficient management experience and capital to make such a program as a long-term deal.

• **Leasing costs.** Such costs for an aircraft would amount to 12.65%, whereas a large finance organization with sophisticated knowledge of capital costs may provide a maximum of 10%.

Leasing Cost

Townsend and the cost to the owner of straight leasing through Intermediate may run about 7.5% of the capital invested. This is approximately 9% of the cost of the money to Intermediate.

One disadvantage to an airline of leasing rather than buying its equipment is the lower total invested capital figure upon which rate-making decisions may be based.

Intermediate is currently working with two overlaid agencies on the "pays by the hour" plan, Townsend

said. Under the plan, a lessor service or corporate operator could have his aircraft—such as it is from Intermediate—and then all responsibilities for the aircraft given to the company. This could include the installed engines and spaces. In connection with an overall agency, Intermediate would provide the initial maintenance and change by the flight hour.

Part of the power would be based on two factors: payment of the cost of the engines, plus Intermediate's profit on its investment and overhead costs plus the involved agency's profit.

Intermediate, continuing several approaches to the used aircraft disposal problem, a cause of great concern to the lessor, the aircraft and airline industries (AW, July 7, p. 26). One plan would

involve the use of aircraft disposal

agencies with prior experience such as Douglas DC-7s, which it says it has in several years as turbine equipment is delivered, with its parts plan to Intermediate, then leases them back and keeps them in operation. The aircraft are immediately listed with brokers, and the intermediaries also try to sell them before the planes are taken into revenue.

The plan, through the sale to Intermediate, has obtained working capital to apply against the price of its new equipment.

Manufacturer's Agreement

Part of Intermediate's intent is to maintain the use of the firm of the lessor. To guarantee the rest of the purchase cost, the manufacturer in some cases would agree to buy the planes from Intermediate if they were still utilized at the time of retirement.

Another plan under discussion with the manufacturer, according to Townsend, is to set up a government-to-government pool composed of a joint shareholders' corporation, Intermediate and the Federal Intermediary Finance Corp. for long-purchase deals with foreign banks at until usage. If such an arrangement could be worked out, credit extended to the foreign buyer would be backed by the organization with the risk split among its members.

Intermediate is also interested in leasing jet ground equipment to carriers, either for individual use or possibly for pool arrangements. Another area of interest is aircraft maintenance.

Financial Credit, Intermediate Credit's parent company, is in the process of buying Cessna Corp., which among other interests has a controlling interest in Bell Aircraft. Financial Credit's interests include 37,700 shares of

Philip Morris Co. Subsidiaries include the following banks and insurance companies:

Bank of Georgia (Atlanta), 96%; Bank of Buffalo (Buffalo), 60%; Industrial Bank of Commerce (New York City), 60%; Union Trust Co. of D. C., 67%; Industrial Finance Co., 99.7%; Northwest Finance Corp., 60%; Bankers Security Life Insurance Company, 85%.

Intermediate's long proposals for an aircraft will offer three means of buying the equipment if the owner so desires. It for the purpose, the airline doesn't want to buy the equipment, it can lease the equipment for the entire life of a normal aircraft, perhaps 15 years, the lessor, however, will be willing to sell the equipment at that time at a certain residual value and the owner can do this.

Other purchase arrangements are a straight lease option to buy, and a straight lease-purchase contract which which payments would go toward the purchase price.

The Chesapeake Report listed the numerous individual criteria required for the use of financing but had not arranged as of April, 1958, as follows:

Criteria	Financing Required	Ref. Not Arranged
TOA	\$333.3	
For American	115.1	
Northwest	63.3	
Capital	33.5	
National	47.5	
American	10.5	
Delta	38.8	
Northwest	28.3	
Eastern	32.6	
Foreign	15.0	
Continental	17.8	
Western	37.2	
United	8.0	
		Europa
Total	570.7	

As noted above, American Airlines indicated its need for new financing, at least at present, by maintaining its major lease arrangements. Continental Air Lines said about \$12 million is to come through use of obsolescence.

Fog Linked to Crash Of Northeast Convair

New York—Northeast Airlines Corp. 120 which crashed Aug. 15 on approach to Narragansett, Mass., killing 12 passengers and injuring 13, encountered fog and low cloud 100 ft. from the air port. One of the injured passengers later died.

Northeast's statements for approach are 400 ft. visibility and 1,000 ft. visibility. For every additional 100 ft. of visibility,

visibility can be reduced 4 mi., down to a maximum of 1 mi. Since there are no clouds at the right of the accident, the legal minimum visibility is 1 mi.

The approach at Narragansett is via VOR. Torness feels the northeast is the only way. Between winter and the airport, the best 1 mi. in bad approach was made to Newark 24 VOR stations at 1.9 miles from the end of the runway. Also, between VOR stations and runways, over 70% of the time, the first landing is within 1 mi.

Worster reported about 17 mi. from the first landing was visibility 1 mi., with no precipitation.

27 Vortac Stations Currently Installed

Washington—Total of 27 Vortac stations are now installed, 150 are expected to be installed in 1959 from now to original schedule, with a total of 146 installed by June 30, 1960. Civil Aviation Services Administrator James T. Pyle has reported to the Legal and Meeting Subcommittee of the House Government Operations Committee.

Pyle and CAA "concur in the need for data collection with respect to resolutions of Vortac implementation, although there are too few complete publications to permit statistical analysis on this matter."

The CAA administrator concluded that there had been many difficulties with initial installations which are only design, initial equipment has solved that this is characteristic of any new equipment. Pyle and CAA are now installing these approaches at least at test stations which implements a number of improvements intended to boost reliability.

Only witness to obtain judgment of Vortac implementation was Mr. Karpas, vice president of the Aircraft Owners and Pilots Assn. and a long-time member of Farnes who has helped expand the Vortac system.

For the reliability viewpoint, Karpas, the reliability viewpoint, CAA has charged that Vortac is "far from acceptable to any segment of civil aviation in its present form." This claim received no support from prepared testimony of spokesmen for Air Transport Assn. and National Business Aviation Assn. who appeared before the subcommittee.

A CAAC spokesman later told AVIATION WEEK that Vortac is concerned at Philadelphia, Pa., and that the remainder will be commissioned shortly as instrument equipment is released by the manufacturer.

Karpas also charged that existing VORTACs are not yet down for use in the winter in order to prevent them to Vortacs. The CAAC spokesman conceded, however, that short-comers of VORTAC now exist no more than 30 days

and in some instances as little as two weeks.

ATA's Milton Arnold, commented CAA, "in demonstrating its ability to make transition from a low-level initial program to one 20-fold greater with efficiency and effectiveness." ATA acknowledged that improvements expected to result from use of long-range enroute aids and increased VORTAC facilities.

He said, however, that the radar has (unplanned) source, but with weather problems. He stated of 97 aircraft in the system, 10% had been lost in bad weather conditions, "we are preparing nonetheless."

Airline Officers Named To Aid AMB Program

Washington—F. B. Quisenberry, chairman of the Alaska Modernization Board, has named seven senior officials to comprise an airline advisory group organized to assist in the Board's research and development program.

The group will act as a consulting agency to the AMB's various technical groups and will actively participate in the Board's research facilities modernization projects. The seven members of the advisory group are:

G. M. Cleverdon, United Air Lines; M. V. Grottmann, United Air Lines; E. H. Carlson, American Airlines; W. W. Lovell, Pan American World Airways; F. C. Nickolson, Piedmont Airlines; W. M. Rughard, American Airlines; and K. J. Rhoad, United Air Lines.

CAB Office Files Northeast Complaint

Washington—Civil Aeronautics Board has been asked by its compliance committee to issue a cease and desist order against American Airlines' "so-called economic activities."

In a complaint filed by CAB's Office of Compliance, the airline is charged with discrimination against other passengers by offering advance reservations and confirming seat space to some of the special services.

The complaint also charges the practice constitutes as "unfair practices," pointing out that unnecessary service reservations were often made as much as eight months in advance and resulted in unnecessary cancellations to get seats. The complaint further states that the airline's discriminatory practices will result in severe damage to the industry.

Karpas also charged that existing VORTACs are not yet down for use in the winter in order to prevent them to Vortacs. The CAAC spokesman conceded, however, that short-comers of VORTAC now exist no more than 30 days

AIRLINE OBSERVER

President Euclidene has been handed a list of suitable candidates for the top job at the General Aviation Board. Euclidene, who has been with Euclidene since the agency's incorporation with Civil Aviation Commission Chairman James T. Pyle as its first deputy, Euclidene's chief concern now is to see the agency successfully launched with a competent staff and working organization. Once this is achieved, he will offer with Pyle's blessing to the administration that Euclidene should nominate for the post is Dick Abram, President Dean W. Bechtel, former CAA administrator and Civil Aviation Board chairman. A member of publication, including Commerce Undersecretary Louis Rothchild, we reportedly ranks a list for the job. The act creating the agency specifically states that the administrator is at the time of nomination shall have had "experience in a field directly related to aviation."

►Delta Air Lines and the city of Atlanta have entered into an agreement covering the construction of a \$30 million jet overbook house at the Atlanta airport. Under the terms of the agreement, the city will issue \$3.5 million in special revenue certificates which Delta will amortize at the rate of \$200,000 monthly for a period of 25 years.

►Aeroflot, Soviet award winner, is publishing the "imperative" of its unique part. Sibavia's competing operation on the new Moscow-Baikal route. Soviet press is emphasizing that Aeroflot's biplane Tu 104s cover the route in 14-15 days as compared with 7 to 8 days for Sibavia's DC-7s.

►Capital Airlines blue-and-white service, called V. I. P. for "very important passenger," on a number of its major routes resulted in a 15 percent load factor increase during the first week of its existence. The airline's sales officials are now hoping that the project will bring about an 80% or higher load factor on the special service flights. Program underway a two-week trial run before it was inaugurated with the company's top-level officers, including President David Polier, flying the trips as critical observers during the shutdown period.

►Pan American World Airways has applied to the Civil Aeronautics Board for permission to suspend its West Coast-Free Polar route service Sept. 25 and to reduce West Coast London polar route service from six flights a week to three. Pan American contends that the route, which Air France is eager to operate (AW 14, p. 11), will experience a heavy traffic drop in winter and that jet aircraft this winter will divert what traffic is available to transatlantic routes.

►Czechoslovakian spokesman says quantity production of the country's first locally produced transport aircraft, the Russian-designed An-2, is well ahead of schedule and that the single-engine 14-passenger biplane will be built at the rate of a 50% higher than originally planned. First Chinese An-2 was manufactured late last year.

►Air of Local and Provincial Airlines is rapidly developing into the sole representative of the local aviation industry and is closing the sharp fissures caused within the industry last year to the creation of six corners from the Conference of Local Service Airlines (NW AW 1, 1957, p. 35). Latest entries to switch from the old to the new Conference are Melanesia Airlines and Pacific Air Lines, bringing total membership of the new association up to more than 12 local service carriers.

►Civil Aeronautics Administration is completing tests to determine the feasibility of operating helicopters under instrument flight rules and on airways. Purpose of the tests is to study procedure requirements necessary to make fixed wing and rotary wing aircraft in normal instrument traffic.

►British Overseas Airways Corp. and Middle East Airlines have reached a profit agreement that permits the sale of the required services of the two companies on routes between Britain and Middle East.

SHORTLINES

►Air Lines reports an operating surplus of \$94,000 for the fiscal year 1957-58 ended March 1. During the period, the airline operated 11,981 aircraft flights in Europe and carried 441,363 passengers and 8,374 tons of freight and mail. Total income was over \$3,456,000 with total expense slightly more than \$3,370,000. The figures do not include operation of American Eastern Irish Airlines, which did not assume transatlantic operations until April 30 which was after the closing of the airline's fiscal year.

►Lockheed Electric Incorporated has passed New York Port Authority "noise pollution" tests. Tests are to test for Port Authority by Bell Aircraft and Norman Inc., acoustics consultants, indicates the Electric is quieter 1-47 dB from start of takeoff than present engines are at a point 2.2 m apart.

►Northwest Airlines flew 1,000,000,000 domestic revenue passenger miles during the 12 months ending Sept. 30. The new company record is 11% higher than the previous period when the airline flew 901,923,000 domestic passenger miles. Northwest's fair passenger miles also increased over last year. The airline flew 109,725,500 domestic passenger miles, a 15.6% increase over last year, and 31,351,510 domestic passenger miles, a 15.8% increase, for a total job revenue passenger mile figure of 140,233,647.

►Olympic Airways of Greece has begun flight on a three weekly basis to Frankfurt, Germany. The airline also plans to extend the route to London.

►Pan American World Airways will extend its South Pacific route from Sydney to Melbourne on Sept. 28 to coincide with introduction of Douglas DC-7C aircraft on the Australian service. Melanesia will have four weekly and domestic weekly. The DC-7Cs, replacing Boeing Stratocruisers, can fly nonstop from Fiji to Honolulu, enroute making a landing stop at Canton Island. This coupled with the higher speed of the DC-7C, will cut out time from Sydney to San Francisco and two hours from Sydney to London via the polar route, according to Pan American.

►United Air Lines reports it broke company records for July by registering 497,140,000 revenue passenger miles, a gain of 1% and 11,258,000 revenue ton-miles, a gain of 5%.



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Stroke	12.00"
Length (retracted)	20.00"
Diameter of female nut	27/16"
Operating load	3300 lbs
Operating speed	2.2 inches per second at 3300 lbs load or 28 inches per second at 1000 lbs load
Weight	12 pounds & handle
Features	1. Adjustable load limit switch 2. Adjustable load limit switch 3. Ball bearing and sleeve 4. Metal shield off when load is increased and when not used

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Type D-1038 actuator in the latest in a long line of actuators, both linear and rotary, that have been designed, developed and produced by EEMCO for over 10 years. Each model has been a precision instrument with built in reliability because EEMCO has always been a specialist in this business. Your inquiry is invited.



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Satellite Controls Pose Major Problems

By Richard L. Sweeney

San Diego—Three problem areas in satellite attitude control were outlined during a recent space exploration meeting here by Robert E. Roberson of North American Avionics' Autonics Division.

Some of meeting papers available elsewhere on satellite attitude control indicated several areas ripe for thorough investigation in this field according to Roberson.

Moving sponsored by the Air Research and Development Command Avionics Rocket Society and Institute of Aeromechanical Sciences, had technical sessions focused on the aerodynamic aspect of space exploration and a human factors session.

Three Major Areas

Initiating the session, Roberson said that three major areas comprising the attitude control of the satellite can now be defined.

The first area he defined as a set of "foundation problems," the second a quantitative description of attitude motion, i.e., formulation of basic equations of motion, and the third the performance requirements.

For the foundation problems Roberson said, is whether the entire vehicle is to be controlled, or only a certain number of its moving parts.

Although the answer will depend largely on mission requirements, some control over the entire vehicle is agreed and has been tested extensively. The question of establishing several parts has not been tested yet.

Second foundation problem is an attitude control system which must work with a satellite with one axis to be kept pointed down toward a nearby planet, and the remaining three axes

rotating around a spin vector.

Roberson also recommended a paper on a basic reference system for spacecraft as derived from standards concerned with geostationary orientation in the solar system which could be a base for a natural attitude reference system.

Controlling the foundation problem, Roberson said, is the choice of a set of reference axes for the satellite and definition of suitable deviation angles between valves, axes and attitude reference axes.

The third area is to analyze the resulting system performance with special attention to the effect of unbalance errors.

A question not raised, Roberson noted, is man's function in attitude control.

Another question not covered, he added, is the general area of design principles to ease the attitude control problem as much as possible. Quoting

the several systems which can be used for this purpose:

The complete control system, Roberson pointed out, is the heart of attitude control, including the control or attitude device, the attitude or rate sensing device, and the control filter or estimator.

Although a number of systems have been mentioned in the literature, Roberson says, not many details have been presented on the methods or procedures analysis.

Three areas which work in especially difficult, Roberson said, include development of new systems for control in addition to such as feedback, robust stability and evaluations of these.

System Problem

Second area is to consider system strength and weight tradeoff through the avionics problem, a problem of significant design.

The third area is to analyze the resulting system performance with special attention to the effect of unbalance errors.

A question not raised, Roberson noted, is man's function in attitude control.

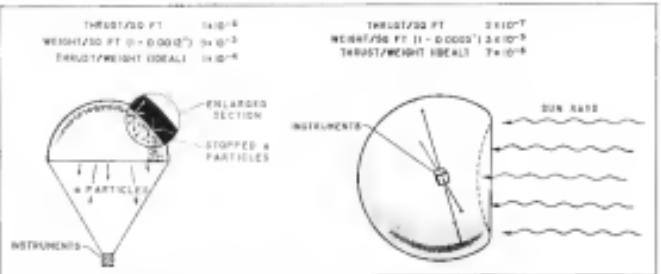
Another question not covered, he added, is the general area of design principles to ease the attitude control problem as much as possible. Quoting

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In spite of the tremendous retaliatory action our Air Force can take in case of attack, the United States Army bears the burden of stamping out the brush fire wars which might ignite the holocaust of World War III. In this heavy responsibility our GIs are backed by the Tactical Air Command which is ready around the clock to provide the Army with the air support without which modern foot soldiers cannot survive. But fire fighting in Kansas or Korea is a dangerous business and TAC will go all out to give its pilots every protection, including Kaman H-43 local crash rescue helicopters.

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NACA Space Vehicles Would Be Self-Propelled

National Advisory Committee for Aeronautics drawing shows a radioisotope sail, left, and a photon sail, right—vehicles designed to propel themselves through space. Propulsion methods are feasible but do not appear promising for most space missions. Both vehicles would probably try for slow speed per unit area of sail. An extremely large sail would be needed to exert a sizable thrust.

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From one paper, he said that "from the point of view of attitude control, a satellite or space vehicle is not a structure, but a precision instrument."

Space Communications:

Use of balloons with antennas mounted thereon, which are inflated in space, was proposed in a paper by Maurice Gobron of Convair Astronautics Division.

Citing that the angular concept can lead to design of broadband antennas, a spherical spiral antenna can fulfill that concept, Chastain said. A design factor is proper relationship of circumference of the sphere and wave length.

Space communications have several problems of their own which such as antenna would help to alleviate, he added, such as the attitude between transmitter and receiver being more than 90° apart, producing antenna bandwidth limitation, the polarization. Another problem is Doppler shift, especially in space.

Space antennas must radiate heat as well as radio frequency signals. Chastain said, indicating the proposed configuration should help in this area or be no worse than present antenna shapes and constructions.

Additionally, he said, a spherical antenna should receive radio signals with nearly all polarization and within a very wide band of frequencies.

Another problem is the collision of stationary satellites held along the spectrum which result from geostationary orbiting with the ship of high velocities.

These goals could very well be attained by probe or loop antenna, Chastain said.

Propulsion Systems:

Three basic propulsion systems for free space vehicles were listed by Dr. Milton U. Chastain of Space Test Facility Laboratories at Ramey-Ward ridge Corp., along with three types of particle accelerators.

One propulsion system let liquid as solar, using photon energy, nuclear fission, which requires a heat transfer matrix and nuclear fission, by which energy and the reaction can be much more efficient.

Research indicates that thermonuclear fusion is most promising when ratios to control the reaction are developed, Dr. Chastain said.

Three types of particle accelerators he outlined are electrostatic, electro-magnetic (ion and dipole), whereby a heat transfer by convection, conduction or radiation is applied directly to the working fluid.

Optimization requires proper matching of these two elements, Dr. Chastain said, with the nuclear fusion and direct

acceleration being among the best priorities considered.

In a paper on power sources for ion propulsion engines by A. L. Heidner and R. H. Bohm of Rockwell Division of North American Aviation, no data storage and solar energy were assumed for their potential, and an array of problem areas considered.

Acknowledging the importance of solar power, Heidner said that one continuing research area is the solar power system. In this area nations have reached a consensus of the nuclear reactor's heat to energy ratio studies, a Bussard-style using lithium gas and a Rankine cycle using nitrogen and alkali metals, which which shows some promise.

Use of the Rankine cycle permits lower nuclear inlet temperatures and requires less pressure, less insulation and to dissipate heat built up in the cycle.

Consideration had a sodium cooled reactor and heat exchanger dissipating heat to a Rankine cycle of thermal energy from the reactor to the propellant tank storage cells. Possibilities of reusing the reactor with the working fluid also were studied, but properties which result a good working fluid are not actually always the desirable ones for reactor and vice versa.

Heidner noted that good hardware is needed for the conversion, among the items being a permanent magnet motor or group of motors capable of working for extended periods in space and under two environments.

Possibilities was discussed of using an electrostatic generator of the type producing current from a change of capacitance of a variable capacitor, which this operates in a vacuum, has a high efficiency and generates a high voltage.

Paper noted that the generator must be cooled. The other parts of a space craft, and flight hardware, a closed cycle air blast or refrigeration system.

Materials Studies:

Five elements of materials, com monly called "aliens," have drawn greatest the highest strengths known in some materials, approaching the theoretical limit of atomic cohesion, according to Dr. George A. Bell of the Bureau of Naval Research.

His paper investigated possibilities of putting this strength to work in space craft, and with unusual characteristics of hypothetical materials composed from "aliens," a composite with weights of various materials from one to several materials per molecule. Weight reduction to one-half present values were seen in possible.

Strength increase with decreasing crystal dimensions begin to climb sharply as whisker size were reduced below one micrometer of an inch,

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big ears of Nike Hercules

Mounts for radar antennas used by the U. S. Army's Nike Hercules to track small missiles and guide the deadly Nike missiles that strike them from the sky are products of the integrated manufacturing and engineering skills of Kelsey-Hayes, working in close cooperation with Western Electric. Capacities range from prototyping to final production. The Space Division is one of seven Kelsey-Hayes Divisions devoted to the production of aircraft and missile components.



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High Energy Oxidizer

residential Board, a nonresidential firm which gives market preflight information about the same project. An improvement in finance is being sought in creative lots by French-owned Corp. Second street laborers are tying the high energy and which can be used safely under tight pressure and at temperatures by 2000.

Dept. James E. Cook, of Holloman Air
Development Center

Neither has more cell damage due to this cause appeared, the paper goes on to say, in applying the various methods by which evidence of cosmic radiation was gathered. The paper reported various experiments conducted in the field of radiation and its effects on prolonged exposure at high altitudes.

Considering a closed ecological system (biotic cycle), it was defined in a paper by Dr. George W. Peck of PRIMIA, Bogotá, as a complex of physical, inorganic and organic sub-environments which independently move in a principle inherent in a state of oligophenological homeostasis and

most useful significant performance. These tests must be carried with negligible system constraint loss, mini-
mized waste streams, and maximum
low weight, extremely high reliability,
and a low detection cost.

Endogenous Subcycles

Ectoparasitic mites on tree ecological niches must include nutrient substrate (chrysophagous substrate), ambient environment substrate. According to Fmc he added that no status existing the chrysophagous mites have been recorded.

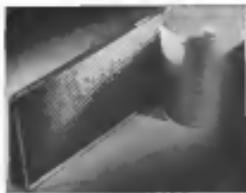
Although much work has been done on nutrient substrate in halophyte seedling germination and root induction, this has been at low salt levels using relatively large amounts of power, weight and space. We went on to use the work with the algae, noting the main cell wall material has as a sustainer life and efficiency.

In the postdoctoral schedule things had, hence. Pete concluded, with his research will end up with although such questions as required knowledge of the event, what information will lead or have required knowledge, can be found in this knowledge an weight research conditions will remain.

fully organized and begin Phase I, for forthcoming orbital flight. Techniques of aerojel techniques will be used, with waste controlled by diet drugs and convenient sealed gas and leakage control. Pre-
pared.

Ambient environment subacute fires may give problems. While recessions in nation a temporary nutritional intervention may be needed. In short term, the energy may be spared for a long time of use in an unpredictable level of energy demands.

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type and volume production. And underlying Solar's systems capabilities is a backlog of more than thirty years of proven leadership in high-temperature metallurgy, aerodynamics, thermodynamics, combustion research and other.

Complete manufacturing and test facilities are also available for your important systems program. For

detailed information about Solar's systems capabilities, or about any of the areas mentioned above, write to Dept. F-40, Solar Aircraft Company, San Diego 12, California.



MISSILE ENGINEERING

How Submarine Fires Regulus II

Regulus II guided missile production has been under way aboard the submarine USS *Greenback* of Mare Island Naval Shipyard, Vallejo, Calif. Submarines are fitted with special forward deck launchers which house the missile. In the pre-launch cycle, carried out at periscope depth, the Regulus II is lowered out of the two forward deck launchers. When clear of the deck, the Regulus II is ignited and moves lower until it is stabilized and secured in flight position. In flight configuration, the missile's General Electric J75 turbine engine is started and run to pre-set power. Once burning, engines are run to the point where the solid rocket booster would have been fired to actually boost the vehicle. Although photo shows a cluster of fins on *Greenback* deck, the fin is largely an aesthetic procedure borrowed from a control room model the submarine Regulus II comes out of deck launcher or special mount is lowered to the site and then fired from deck (AM, June 21, p. 43). *Greenback* Aircraft Division utilizes an Avro Canada nuclear-fueled J75 engine that produces about 15,000 lb.



Hangar deck (right) are closed in reverse order, missile leaves port launcher (below).



Near bottom, wings are folded (left) and in flight position (right). *Greenback* (bottom), ending run.



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Australian Malakka Missile Nears Tests

LONDON—About 10 Australian Malakka anti-tank guided missiles will be fired to test the weapon's range on the Salween River of Southeast Asia next month. Lt. Col. H. S. Long, of the Research Development Establishment, Kemalang, said it is unlikely that Malakka will be fitted with explosive war loads for some time. Malakka is a 200 lb ground-to-ground solid controlled weapon (AW, August 15, p. 37).

Britain has ordered 160 Malakkas from Australia. Estimate of the weapon was disclosed by Acheson Jones, Minister of Supply, during a tour to Melbourne. The maximum price datum of a contract worth \$4,480,000 for 160 Malakkas is \$10 January, target date.

Malakka was developed by Marconi at Government Aircraft Factories, Midland. It can be used against tanks, self-propelled guns, bridging craft and small ships. It is launched from a mobile platform.

Canadair to Produce Sparrow II Missile

Ottawa-Canadian government will spend \$14 million this year on production of the Douglas Sparrow II anti-aircraft missile.

Canadair Ltd. is producing the Sparrow II day and night Air-to-Air (AAM) 105 ft/siles. Company personnel worked an 18 million preparation, planning and engineering contract for the missile. Tooling costs will amount to about \$2.5 million.

In other Royal Canadian Air Force contracts, a total of \$169 million will be spent for production of 23 Canadair CL-38 Argus anti-submarine warfare aircraft. Price includes engineering and development costs.

Canadair also has received a \$24 million contract to produce eight CL-44 transports. Aircraft will be in service with Royal Canadian Air Force. The company also has received \$8 million for CL-44 engineering work, plus \$12.3 million for tooling costs.

PRODUCTION BRIEFING

Westinghouse Electric Corp., Los Angeles, Calif., will build electrical equipment to power armable shelters for the Thor missile under \$1,750,000 contract. Shelters, enclosing automatically positioned missile, is equipped to roll back the length of the missile prior to launching and firing.

Aerospace Division of General Precision Avco, will develop component systems on the Atlas IBM under \$1 million contract.

STRUCTURES



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complete auxiliary and accessory
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Over 50 years of experience in developing metals and designing components for power plants gives the Tapco Group a vast experience in research, development and manufacturing of assemblies and components for propulsion and power systems and sub-systems.

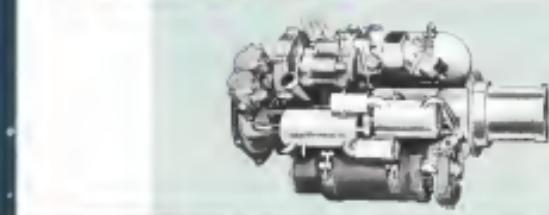
Now, Tapco's capabilities have been broadened to include most phases of nuclear-power plants and accessories. Research is under way on the special metallurgical problems associated with radiation effect.

Fuels for all types of engines and power plants are collateral research projects at Tapco, where complete facilities for research and evaluation on solid-state, liquid and nuclear fuels are in existence.

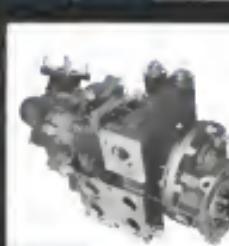
Function testing of nuclear reactor control rod drive mechanisms in a simulated vessel head, part of Tapco's continuing research project on nuclear reactor components and control systems.



► Special problems of forming, heat-treating, and resistance welding were solved at Tapco in producing this large weldment for jet engines.



Self-contained sub-propellant auxiliary power unit designed and built at Tapco to produce electric and hydraulic power



At left: Combination main and afterburner engine-drive fuel pump now providing thousands of hours of trouble-free service in production fighter aircraft.

At right: Rocket engine turbo pump now in production at Tapco for use in several of America's leading missiles.



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Submerged Tube Launches Polaris In Navy Tests

Technique for launching the Lockheed Polaris test ballistic missile from underwater is being tested near San Clemente Island off southern California by the U.S. Naval Ordnance Test Station (AV 4/21, p. 31). An exact Polaris missile is hoisted into a launching tube which is pulled down to a launching pad on the ocean floor by winches operated from shore. The underwater launching tests are intended to detail the usual and unusual circumstances possible beneath the ocean surface, and concerned in a similar large in the test area.



Valve drives work as set at Polaris underwater launching test site. Nuts are designed to enable test Polaris missile as it falls back to ocean after being launched.



Navy's Lockheed Polaris test ballistic missile is lowered into a launching tube which will be towed to San Clemente Island sea range of the U.S. Naval Ordnance Test Station where underwater launching tests will be made.



Inset: Polaris missile rises from ocean's surface after being launched from underwater tube at San Clemente Island test site.



Can anyone build a missile?

Theoretically, yes! Today, even the sandlot Leonardo's and knee-pants astronauts are building them.

The problem in this business is to stay ahead of the game, working today on the programs that mark the way into the future. The end result—five to ten years later—must be far more than a missile. It must be a complete operational system, integrally engineered from concept to completion of the mission; produced in facilities totally integrated for designing, building and testing by engineers and scientists who know and understand the problems and requirements of the military. The payoff is in full payload performance in the field—time after time—with military personnel setting it up, proving it out, and operating the controls.

For the creation of today's most advanced missiles and the big space vehicles that are now in the planning stage, Martin capabilities are among the finest in the world. They are the result of a planned program of manpower and facilities development which commenced nearly thirteen years ago with the opening guns of the U.S. Middle Ages.

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transistor have been developed by ARA, but their design has not yet been finalized, which explains why the company has not yet obtained JEDEC designation for them. Three units in class:

• ARA-25P, PNP transistor, with current gain of about 15,000, input capacitance of around 5,000 ohm, cutoff frequency of 7.45 megahertz, also rated 10 watts maximum power dissipation, 3-wire肖特基 collector circuit.

Novelty of the latter units is the fact that current flow between emitter and base is opposite that of conventional PNP and NPN units. This provides compensation built which can be combined with PNP and NPN transistor to give equal current designs. For example, a 10-watt, 100-milliamper, ± 25% PNP unit can be combined with the NPN unit to provide the push-pull amplification and to eliminate the need for a separate phase inverter.

Advanced Research Associates also has developed a short-circuiting diode, type ARA-D1124, designed to protect transistored equipment against instantaneous voltage of ± 0.5 line voltage above 20 volts. The device, measuring $2 \times 14 \times 18$ in., contains a Zener diode in combination with a composite-varistor. When connected across 25×0.5 in. apart terminals of a transistored equipment, device serves as a short-circuit of shorting up to 15 namp and protecting voltage applied to the



Microwave Filter

New "sputtered" microwave filter for waveguides, developed by Standard Research Institute for Herstek-Pustek Co., Palo Alto, Calif., reportedly is easier to fabricate and accepts less space than previous waveguide filters. Unit shown has a 10 to 15% loss (approximately 10dB) passband. Design design has been developed for 26.5 to 40 GHz.

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RAFT OF MAINTENANCE Roy Fehner says, "We sell to ACs! Our service records prove their reliability and performance!"



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equipment from exceeding 291 v., resulting in 100 kVA.

Advanced Research Associates currently is working on a composite transistor which is expected to be able to control band narrow of 200 wpm or more from low-level signal applied to its terminals.

Part of ARA composite-transistor rates between approximately 8112 and 8175, depending upon type and gain, 10% ordered. The short regulating diode rate ranges between 587 and 523. A number of companies have bought composite transistors for evaluation, Walker says.

Advanced Research Associates was

founded little more than a year ago by Walker, a former director in the military-grade transistors of Bell Telephone Laboratories, and Dow Walker, company vice president. Prior to coming to the United States with Bell Telephone Laboratories in 1958, Walker had developed a line of radio controls for drivers. This was the first line of products which ARA marketed after it was formed.

The company has developed a number of microwave high efficiency rotors and linear actuators as well as related transistored servo elements. Customers include the National Aviation Committee, the Aerometrics and Radioglobe

The new composite-transistor is an offshoot of ARA's efforts to develop transistored transistor amplifiers for use in its driver/modulator circuits and control systems.

Compton now has about 20 full-time employees plus five outside consulting engineers on a part-time basis. It is involved in a major avionics manufacture in using composite transistors for high-production defense equipment development into an order, the company expects a major expansion.

Advanced Research Associates address: P.O. Box 85, Kensington, Md.

British Plan Four ATC Radar Points

London—Further details have been released on Britain's four-year plan to modernize its air traffic control system. The plan, authorized in the Ministry of Transport and Civil Aviation, will cost about \$15 million.

Beginning this year, the plan foresees six long range radar stations at four strategic points—southeast England, Manchester, the west coast, and east Fife/Perth, Scotland. At these stations, electronic equipment will receive static and flight information required by the air controllers.

Following the plan due to increasing traffic and lack of airspace over Britain, the time to reduce the amount of radar communication between aircraft and ground. This results in an extension of the ATC ground radar coverage. The four new radar stations will have a low level range of 35 mi. and a high level range well over 100 mi.

Radar information will be transferred calls and by three point-to-point ATC systems in London, central England and Scotland. In the control stage the information will be displayed on plan position indicators and flight displays. The displays will show the aircraft's position and then an addition individual aircraft altitude and height. An electronic key will automatically feed each individual controller with the pertinent information on his sector.

By parallel means, plans to introduce an air-traffic control equipment for handling of flight plans submitted to the air traffic controller prior to departure. The ultimate air-traffic control combination of flight plan handling within the air traffic control organization.

Electronics industry has already submitted to the Ministry detailed proposals for the four new radar stations while the MTCA is in its traffic control experimental unit is studying the requirements of the second phase, the development of suitable information display systems.



STRAIGHT TALK TO ENGINEERS

from Donald W. Douglas, Jr.

President, Douglas Aircraft Company

I've been asked whether non-aeronautical engineers have good prospects for advancement in the aviation industry.

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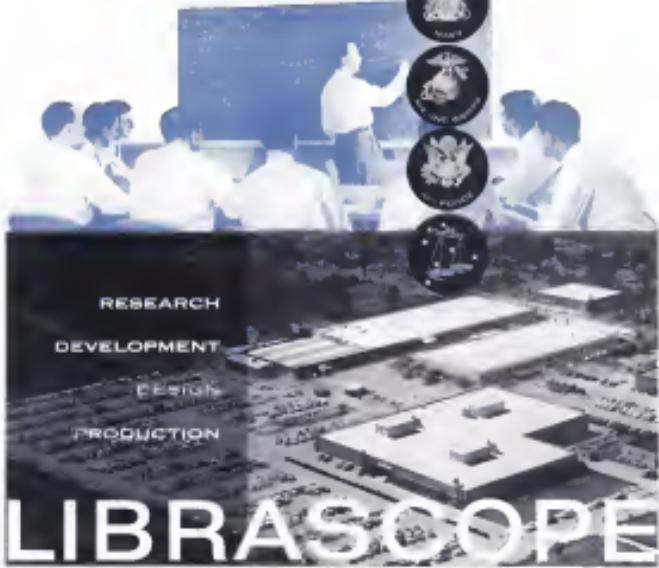
For the complete story on Edo Model 100 Avionics Receiver
and for Technical Bulletin #20, "Dope - G-7,"

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Chance Vought Forms Avionics Department

Chance-Vought Aircraft Inc. has formed a new Electronics Engineering Department to manage avionics systems going into the company's fighters and bombers and to do basic electronic research and development.

Electronics activities have been consolidated in one department under the direction of Dr. James F. Regan, Chief Electronics Engineering Department.

The new group has about 350 engineers, including 150 engineers and technicians. Vought says the new group will be expanded to meet future needs, future technological capabilities and support test capabilities.

Formation of the new department reflects the growth in electronic activity at Chance-Vought since 1955 when 20 employees were involved in the field.

Now the company manufactures about 5% of all the electronic equipment which goes into the Convair aircraft and Regulus missiles.

Electronics Engineering Department will be responsible for aircraft avionics, electronic systems, and a cell program in Chance-Vought's share of the Boeing B-52 bomber project.

Earlier this year, Chance-Vought entered into the field of commercial aeronautics when it formed the General Corp. in Los Angeles, Calif. This wholly-owned subsidiary specializes in the design, development and production of advanced computer systems, computers and allied products, with the emphasis on commercial and industrial applications.



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TURBINE-POWERED S-62 can water land up to 15 ft, from 300 deg. in 60 sec. length. Aluminum hull incorporates fire suppression.

Airline Week Pilot Report

Turbine Cuts Noise, Adds to Simplicity and

By Robert L. Stanfield

Bridgewater, Conn.—Effectiveness of new flying boat-type hull and lightweight gas turbine engine is reflected in the great water handling and flight characteristics of Sikorsky's amphibious S-62 helicopter.

Piston-powered S-62—currently powered by YT15-CB-6 engine—also evidenced inferior quietness and lack of vibration during flight evaluated by AVIATION WEEK, the first such report on a U. S. turboshaft helicopter.

Turbine-powered helicopter outshines the dynamic parts of Sikorsky's S-61, including the noise reduction level with the General Electric T53 or the coming T55 engines and a new fuselage.

S-62 is up to 998 lb lighter length, weight than the piston-driven S-61 (16 ft, 2 in. 28,700 lb).

Turbine engine's output is rated at 650 hp, at the report to the main gearbox. That is based on the S-55's YT15 engine output of 700 hp, less the difference between piston engine fan losses and gear losses in the new engine set.

Silently it is the prime of flying the YT55 fuel control and so that full power of engine—1,025 hp—will be available, thus reducing power losses in hot weather.

S-62 Performance

Evaluators pointed up these key features of the S-62A:

- Controllability. Helicopter is more responsive to light control forces, response more rapid than flight averages. Main lateral waves are similar to those of the S-61, though, no mechanical feedback.

- Water Handling. Annotations were made over Long Island Sound from 3,000 ft. Wind was from the southwest at 10 ft, with wave about 2 ft. Water controls were light to moderate. There was no judder in roll or dog bite. The S-62 was tested into 960 deg. flight turns, rolling solid in water at same power. Both the S-61 and T55 are capable of dealing with the roll transition, taking up to 510 deg. of yaw bank in 10 sec. up to 154°. For standard conditions, the T55 is rated at 1,050 rpm. static and 930 rpm. rated maximum; the T53 is rated

900 rpm. static and 835 rpm. normal conditions.

While power on the production aircraft is presently limited to the maximum, the B-model of the S-61, which Sikorsky expects to be in production next year, will incorporate the S-62's motor system and a new gearbox. Upgrading of the T55 engine is expected to produce up to 1,075 hp.

S-62 Instrumentation

• Water Landing. Annotations were made over Long Island Sound from 3,000 ft. Wind was from the southwest at 10 ft, with wave about 2 ft. Water controls were light to moderate. There was no judder in roll or dog bite. The S-62 was tested into 960 deg. flight turns, rolling solid in water at same power. Both the S-61 and T55 are capable of dealing with the roll transition, taking up to 510 deg. of yaw bank in 10 sec. up to 154°. For standard conditions, the T55 is rated at 1,050 rpm. static and 930 rpm. rated maximum; the T53 is rated



THROTTLE quadrant and control panel are easily accessible to both pilots.



HELICOPTER'S hull is sealed to prevent air entry continuously. Three watertight compartments from shielding prevent

Power in S-62

to 1,075 hp. Normal cruise speed is estimated at 123 kt., as compared with 98 kt. for the S-61A.

Presently, first flying evaluation was N62. Along with Aviation Week pilot Frank Tamm and two passengers, basic weight of aircraft, with instrumentation, was 4,758 lb. With complement of five, plus 1,150 lb. of fuel (1782 gal. of JP-4) and 31 lb. of oil, helicopter's gross weight was about 6,700 lb. Maximum allowable gross weight is 7,500 lb.

Cabin was cutout through 4 x 5 ft sliding center door on port's right side. Interior is spacious, but is large enough for up to 12 passengers or six freight, plus six crew members. Platform on aft deck, plus 60 cu. ft. storage compartment, is on aft deck. Cabin measures 14 ft. long by 5 ft. 4 in. wide and is 6 ft. high.

Cockpit is roomy and comfortable, with large glass area that affords excellent forward and down vision. Looking straight ahead, pilot gets 155 deg. up-ward visibility and 315 deg. downward visibility. Quartering side upwind at takeoff/level gear further down wind range, and there is an extra ceiling



6-KE ENGINE and flight instruments are mounted ahead of pilot. Dual instrumentation is optional. Included are dual collective and cyclic throttles.



FROM THE DESERT TO THE ARCTIC...

First helicopter ever developed to meet specific Army requirements for front-line duty, the Bell Iroquois is now taking a series of rigid Army "final exams" before going into action in the field. One of them is the Army Aviation Board's arctic testing, which will evaluate the compatibility of equipment and military personnel in their normal operational environment.

Designated the Iroquois by the Army, this all-new, turbine-powered helicopter will be tested by the Board under simulated battle conditions to show the factors of weather and terrain full play. At a special site near Yuma, Arizona, the Iroquois will go through the "baptism of fire" in the desert heat. One of the most important checks here, and later at Ft. Rucker, will be made on the Iroquois' tactical capability for troop transport, medical evacuation and emergency resupply. In the arctic theater at Eglin Air Force Base, the Iroquois will go into the deep freeze of -60°F. Then it will be off to Alaska for actual Arctic testing.

Conclusion of the complete Army shutdown will make the Iroquois one of the most thoroughly tested helicopters in the world...superbly capable of front-line duty...ready to keep Army Aviation "Above the Best." Bell is proud of its role as partner in military aviation progress...of its ability to supply the finest equipment for the military.

U.S. ARMY AVIATION BOARD TESTS THE IROQUOIS' METTLE



FORT WORTH, TEXAS • SUBSIDIARY OF BELL AIRCRAFT CORPORATION

S-62 Performance Comparisons

	S-62-0	S-62-1	S-62-1	S-62-1
	LAND VERSION	WATER VERSION		
Gross weight (lb.)	11,200	11,200	7,100	7,100
Zero weight* (lb.)	4,210	4,440	4,120	4,950
Useful load (lb.)	5,210	3,810	3,720	2,250
Crushing strength (lb.)	58	58	78	58
Maximum speed, on level (mph)	118	119	112	119
Hovering ceiling, not ground effect (feet)	8,000	8,000	8,000	8,000
Hover ceiling (ft.)	15,700	14,800	11,700	14,200
Vertical rate of climb, not level (ft/sec.)	400	400	400	400
Rate of climb, not level (ft/sec.)	1,100	1,100	1,100	1,100
Fuel consumption at cruising speed (gph.)	60	60	60	60
Range with 100 gal. fuel plus 10% reserve of existing speed (mi.)	230	230	230	230
Seating — maximum passengers for one cockpit and either 12 troops or eight military type seats				
Seating Rating (s)	130-GR-4	700-A-144	130-GR-6	130-GR-144
Max per the class	1,030	10,000	100	10,000
1967	100	100	100	100
Fuel output at max fuel rating (gph.)	470	470	470	470

*Zero weight includes frequent hover, useful load about 1,000 lb.

**Operated GR-1. As an interim rating, the S-62-1 is certificated at 821 mph. max, over 100 ft. min.

David Morris, Convair, has been assigned to approach the same level as the S-62 that would reduce an altitude of 100 ft. to 55 mph.

At 1,000 ft., initial cruise-rated rpm 91% gas generator rpm, 85%—the S-62 reduced 9% at increasing power to maximum 93% rated rpm and 94% gas generator rpm—compared with 90% for the S-62-1. Redundant fuel system is not known to 150 ft. S-62-1 had no fuel system. Light control forces in much that Vmax was 100 mph. but had no aeroelastic response in order to curb overcontrolling. Vmaxible throughout was controlled.

No inflation rating is required to penetrate because of the S-62. The blade bending stresses in static test flight are of balanced loads. In comparison, flight with the blade short-term, considerable weight savings are realized.

The main hull encompasses five compartments. At gross weight with one seat not in, two sit forward, the helicopter still sits flat. The two stabilizing spars are divided into three subgroups: components. Club and compartment is necessary to hold the tail and cockpit. In addition to the main door, located just off of the right cockpit, the S-62 escape cuts include pilot and copilot's side windows, tail fin, tail boom, rear window on the right side of the cabin, and two windows on the left side of the cabin.

Before landing, blade stall was simulated at 1,000 ft. This wasn't easy, as we were flying below gross weight with gross speed reduced and weight limitations there is nothing to counteract. Straight ahead, with motor rated 85% and helicopter indicating 90 ft., we couldn't stop. We did in putting the S-62 in a land turn to increase centrifugal force and weight. This was most vibration. Recovery—reducing collective

Straight ahead, with motor rated 85% and helicopter indicating 90 ft., we couldn't stop. We did in putting the S-62 in a land turn to increase centrifugal force and weight. This was most vibration. Recovery—reducing collective

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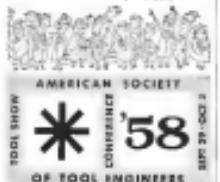
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DETROIT 32, MICH.



patch and increasing color speed—was used.

Leading at an approach speed of 60 ft and descent of 1,500 fpm, was preceded by a legitimate landing of the S-62 at 125 ft. Engine was shut off after first touching back to ground after a cooling down and coast.

After initial operation, the S-62 can be maneuvered by adding alternate stabilizer deflection developed by Sikorsky for the S-55. Autostabilization equipment operates control action without moving pilot's levers, maintaining course, speed and altitude. To accommodate autostabilization, an additional servo system would be installed in fore and aft control.

S-62 controls and cyclic, collective and directional control systems. Primary hydraulic servos are mounted on the main gear box for the main rotor control. Auxiliary lateral servos are mounted on the aft face of the pilot's seat bell-crank. Primary servos are supplied by pump mounted on the main gear box. Auxiliary lateral servos are supplied by the cabin status pump.

Both hydraulic systems are interconnected electrically so that should the operating pressure in either system drop below the normal operating pressure the other system cannot be switched off. If the helicopter is operating with one system off and a failure should occur in the "on" system, the "off" system will automatically come on. There are no auxiliary servo on the fore and aft and collective pitch control system.

Primary servo system consists of three S-55 primary servos mounted in the structure and hydraulic power is obtained by a servovalve driven pump driven by the main engine.

Operating pressure for this system is 1,200 psi with a rated valve setting of 1,200 psi. Hydraulic power for the auxiliary system is obtained by a separate variable delivery pump also driven by main rotor gear box. Operating pressure for this unit is 1,100 psi with a rated valve setting of 1,700 psi.

S-62 control dimensions are as follows:

• Main Rotor—Dial area, 2,206 sq. ft.; blade area (each), 32.5 sq. ft.; radius, 9-1/2 in.; weight, 100 lb.

• Tail Rotor—Dial area, 55 sq. ft.; blade area (each), 1.6 sq. ft.; radius, 10-1/2 in.; weight, 60 lb; weight, 0.0032.

• Stabilizer—Area, 85 sq. ft.; span, 65 in.; chord, 17 in.; aspect ratio, 8; airfoil, 6035, angular measurement, pitch or moment 15 deg.

Sikorsky built its own gearbox for the S-62 at a weight of 60.76 lb of weight. Main gearbox also is used as nose cap support for engine. Ratio is 9.1, 20,000 rpm for free turbine and 211 rpm for main rotor. The 20,000 free turbine rpm (max.) causes us to use gearbox



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20-30 years.

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in one-stage, high speed transmission, which compares us in weight to standard gear gears. Free wheel and clutch. Sikorsky has automatically damage resistance from logic in event of engine failure, and make an automatic landing. Upper part of main gear box is at 8.55 in. off the axis.

Helicopter, which can land 2,000 lb of equipment, is ground to meet military load requirements, fatigue and strength. Design loads itself on wide range of situations: emergency stops, turning and maneuvering, suspension landing, aerial maneuvering, for fighting, transport and supply, and general utility (AW 1002, p. 74).

Price will run about \$215,000-\$220,000, depending on whether the customer wants the General Electric T53 or the lesser powered Lycoming T53. Installation of the former adds \$77,000 to the aircraft's useful load. Load variation of the S-62, lowest bell and boom, is fitted with conventional fuel tank landing gear. Load variation is highest in landing gear, and carries 100 lb more payload.

Second prototype S-62, now being used for instrumentation flights, was being tested by Army or Navy for evaluation, in which case the third could—out by the end of the test—will be used for test work.

Program calls for complete completion of the aircraft before the end of 1969. By the third or fourth quarter of 1969 engines will be available. Non-qualified military aircraft can be delivered in 10 months following order.

Operating Costs

Operating costs for the S-62 are expected to be about 10% less than those of the present cargo S-15. Optimum operating cost for the latter, assuming regular scheduled carrier operation of 7,000 hr per year, is \$75 per hr plus \$1.50 per ton mile.

Cost savings in military purchase of the S-62 A at \$1.50/sq. ft. Sikorsky capital, would be the need for only a few hundred more miles than those aircraft. Regent immediate savings would be the skipping of purchase of spare components because of the aircraft's reliability. The S-62 would reduce 650,783 lb overland components with same life of existing components in \$400,000 to weight, Regent Webber was told.

Existing components of the S-55, and in the S-62, include more rotor blades, hub with bolts, blade shear rotor head, tail cone head, main gear box with new power rated section system, auxiliary gear box, tail gear box, steering, flight control (single piston) in sliding servo and S-15 rotary unit, major parts of hydraulic system and hub rotor piston.

ENGINEER OPPORTUNITIES AT RAYTHEON



Newly formed project groups solve complex airborne radar problems

Engineers like the project-type organization at Raytheon's Maynard Laboratory. It gives them maximum diversification in their work on the most advanced radar, navigational and control problems of the day.

At Maynard, you'll find projects involving many areas of aircraft navigation and guidance systems—doppler navigation, velocity check systems, night-fighter operations systems, flight-control systems, airfields. There is also interesting work on chapters on aircraft equipment.

Career opportunities for men at all levels now exist in the following areas:

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TRAINING, center: pleasure and business flying are fields for which new four-seat Cessna Model 310 has been designed.

Cessna Re-Enters Two-Seater Market

Wichita, Kan.—Introduction of new side-by-side, two-place all-metal Model 180, in October, will provide Cessna Aircraft Co. with the broadest product representation in the business flying market, comprising a total of seven aircraft types.

Model 180 is the first two-seater in place-hold in the Wichita, Kan., company's line. Model 180, which was discontinued in 1950 and a subsequent sponge as business flying resulted in heavy emphasis on this plane's private replacement. New acquisition is an attempt to supply a growing demand for a modern all-metal two-seater.

Cessna reports that it already has firm orders on its books for 600 Model 180s from its distributor organization, in addition to another 115 being allocated for export. The total estimates the number of airplanes it had on order for operated buyers (not pilot's own use) and unsold aircraft.

Cessna expects high initial volume and long production life for its new airplane. Standard in side position, the Model 180 will be available in three versions:

- Standard, priced at \$7,995, which includes a standard equipment of a small five-pitch propeller, starfire 2015-1500 gearmotor, recording tachometer, standard altimeter, navigation lights, single-point oil pressure, oil temperature and electric fuel gauge, cabin heater, stall warning indicator, air speed indicator, parking brake, lockable rear operated brakes (not pilot's side), and convertible nosewheel.

- Turbine, priced at \$7,995, having a Pratt & Whitney with nose cowl, standard engine controls, a standard five-pitch propeller, tailwheel landing gear, one of choice, one-piece air temperature gauge, dual controls, landing lights, reversible altimeter, clock with秒, chronometer lock and auxiliary lights.

- Extra-low maximum, at \$8,145, includes direction and horizon gyro with engine driven vacuum system and the standard rotating horizon. This model also has all of the standard equipment except the dual controls.

Available on the future will be a special "pilot" wing with additional fuel capacity for pilot fuel, pilot oil, other aircraft equipment and reserves.

Model 180 is powered by a 145-hp Continental C-800-B engine, providing a top speed of 124 mph at sea level and maximum recommended cross wind of 121 mph at 70% power at 9,000 ft. Range at maximum cruise is 570 mi or 8.5 hr. At economy cruise using 47% power at 10,000 ft, the Model 180 will have a range of 630 mi or 8.6 hr at true airspeed of 95 mph. Fuel capacity is 26 gal, with 12.5 gal comprising the selected airline fuel.

Plane is designed for a 740-lb rate of climb and service ceiling of 15,100 ft. Gross weight is 1,890 lb; empty weight is 1,467 lb. Dimensions include

wingspan, 35 ft. 4 in., length, 21 ft. 6 in., height, 6 ft. 11 in., wing area, 169 sq ft. Wing loading is 9.9 lb/sq ft, and power loading is calculated at 15 lb/sq ft. Maxium unoperated wing flap load is 17.76 sq ft.

The Continental C-800 A has a rated 100 hp, at 2,750 rpm. Recommended engine limit has been set initially at 800 hr. Dry weight is 109.6 lbs., 21.4% remaining maximum. Dry pressurized at 200 psi in and with a 25-degree climb. Fuel requirement is 50/50 octane.

Landing gear is same chrome vanadium steel spring type used on previous Cessna. Tires between main gear is 77 in. and is designed to provide good

ground handling characteristics in sand weather. Gear is fixed with new Goodyear gearlocked brakes having matched gears and teeth around the perimeter of the wheel chills and made like wheel casting, replacing bars and slips previously used to hold the chills in place. There is a rudder with solid tailwheel tires, all 3.00 x 5.

Top and bottom of the seat are adjustable forward and back, top of the seat folds forward to provide access to 55 lb capacity baggage compartment. Above the baggage compartment is a cubby hole which can be replaced by a child-size seat, capable of holding two, which will be available as far from the factory as agreed.

Cessna Readies 210 For Late 1959 Sale

New single-engine Model 210 business plane ("of advanced design") is being flight tested by Cessna Aircraft Co. and will be available to psychiatrists as late as 1959.

Configuration and performance details are being kept tight by Cessna Aircraft Co. President Donald V. Doman, Vice President General Manager, Dale Radlau will only state that the Model 210 will give the psychiatrists an entry in the high-performance, single-engine market between the Skylane (top speed 365 mph) and the 180 (152 mph).



INSTRUMENT panel shows equipment on intercity model, except for dual controls.



MODEL shows configuration of two-seat turbine helicopter Domax is designing. Minimum speed would be 180 mph.

Doman Designs Turbine Helicopter

Doman, Conn.—Preliminary engineering has been completed by Domax Helicopters, Inc., here, on a new two-place turbine-powered helicopter designed for a top speed of 180 mph. Company estimates that in production quantities, its new Model D-12 will sell for approximately \$12,000.

Project is based on a design study made by Doman for the Army Proving Grounds at Fort Rucker, Ala., the D-12 is the new 250-hp Allison 250-C1 turbine, which was winner of a motor aircraft competition (AW, July 21, p. 26). Engine

weight under 100 lb, fuel consumption is approximately 7.7 lb/hour, fuel capacity is 140 gal, and landing gear total 7.5 ft.

Max. rate would be a nose down change of 22.5 ft., can be varied according to the helicopter's application. Piloted version would be over a smaller nose. Doman states fuel tank diameter is indicated at 3.5 ft.

Design is planned for quick maintenance and maximum accessibility. The engine is built with all components of transmission, powerplant and referee system arranged so that they can be serviced or replaced without disturbing other elements.

NEW AVIATION PRODUCTS

Polaroid Aerial Camera

Polaroid sporting camera, developed for aerial reconnaissance photography, is used to take pictures where instant photographs are needed.

Model 110 has a 10 in. focal length 1/16 Bague telephoto lens and uses eight exposures. Polaroid aerial camera is made of an 8×10 square frame, 30 sec. and, in the United States, Shutter speeds are 1/125, 1/250 and 1/1,500 sec. Achromatic lenses, weight

ing 8 lb., is designed to be held in the hand.

Most Development Co., Inc., 2343 E. 12th St., Des Moines, Iowa.

Self-Cleaning Fuel Strainer

Fuel strainer cuts downstream costs of a series of filtering components and of reverse turbine fuel jet cleaner is used in the petroleum industry for filtering solid dirt of water and petroleum products.

Particulate earth is added to jet fuel to be filtered. Powder forms an open, porous cake which is fine enough to trap contaminants but porous enough to let the filtered fuel pass through. Strainer can melt through a system of revolving pins which wear the strainer and flush out solids.

Thermal Control Co., P.O. Box 1184, Houston, Tex.

Ground Support Compressor

Portable air compressor for ground support of aircraft and missile systems is used to meet all pneumatic needs except that of fuel air starts or gun.

Compressor is available in both electric and gasoline engine powered models. Model 1500E3500 (shown) is the electric unit which operates on 200

and 300 psig. Flow rates under these conditions are 8 to 20 scfm of air or nitrogen. Regulation range 1.5 to 1.

Walker G. Leonard, Inc., 1718 S. Forth Ave., Pasadena, Calif.

Emergency Hydraulic Valve

Reactive acting, panel mounted manifolds for up to 200 psig pressure hydraulic or vacuum service is designed for emergency control applications, where fast push-type action is desired.



Reactive action is imparted by a stranded spring return and actuated, mounted on a two, three or four way manifolds valve body at rates from 1 through 1 NPT. Valves are designed to be standard pressure control valves.

Valve Corp., 414 Maingate Ave., Akron 11, Ohio.



Jet Aircraft Tire

Aircraft tire with dualized tread design is used to withstand and outlast other jet tires. Photo shows 30-8.5 tire mounted on Convair F-106.

Police tread tire will be standard on the F-106, the first Convair aircraft.

It is made of a series of thin steel cables and hoses are attached to the tire hub through the center. Cables are spent as they run through the center and center is then fastened with fasteners.

Co-Brake Co., Inc., 1929 E. Co-Brake Dr., Denver, Colo.

High Pressure Oxygen Pump

Standby and integral gas pump, currently being tested at Edwards Air Force Base, passes to 10,000 psi with flow to 10 gpm, the maximum man rate. It is used for mobile mounted oxygen or nitrogen refrigerators.



Isolator Station or Cascade System

Pump is a fire exhaust respirating action type is 16 in. long and weighs 190 lb. in its portable configuration. Handing liquid oxygen, nitrogen or argon, pump is used to move industrial as well as military applications.

Delavan Research, Inc., subsidiary of Air Products, Inc., Allentown, Pa.

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Control Systems Evaluation Engineers. Responsible for initiating and developing methods for evaluating programs in engine control and auxiliary systems and for designing, processing and evaluating selected sub-systems of slave engine controls.

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JET ENGINE DEPT., CINCINNATI 15, OHIO



volt, 400 cycle, 1 phase current. This model delivers 2 cu. in. from 90 to 3,000 psig. Weight is 92 lb. Model JMKR-200, weighing 130 lb., is operated by a 21 hp single cylinder 4 stroke gasoline engine. Gaskets provide temperature delivery from 2 to 4 cu. in. of air to 3,000 psig.

The Comelco Co., 590 38th Ave. NE, Minneapolis 21, Minn.

Hydraulics Pneumatic Regulator

Two-stage pneumatic regulator is designed for pressurization of instruments or bearings on missiles. Multi-poppet design is used to provide close regulation of outlet pressure over a wide range of inlet pressures.

Regulator is used to maintain an adjustable outlet pressure of between 50 and 160 psig within ± 0.5 to ± 2 psig at inlet pressures ranging between 1,000



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Mystere IV-A Acrobatic Team Maneuvers

French Air Force aerobatic team demonstrates dual capability of Dassault Meteor IV-A aircraft in powered by Hispano-Suiza V-12 engine producing 7,700 lb. thrust

WHAT'S NEW

Publications Received:

Impedance Matching - by A. Short, Ph.D., Ed. D.-Farr, John F. Rider Publishers, Inc., 116 West 44th Street, New York 33, New York \$3.95 113 pp.

This electronic technology series deals with the problems of impedance matching at audio, radio, and higher frequencies. It also explains the theory, underlying problems and solutions of impedance matching.

Instruction for Disassembly-Edited by George McLean-Pugh, Columbia University Press, 1969 Broadway, New York 27, N.Y. \$5.80 291 pp.

This book deals with a major point of danger in systems of inspection to ensure compliance with any disassembly program or agreement which might be made with international customers.



The Hitchhiker-by Irvin Shapiro-Pugh, The Macmillan Co., 60 West 45th Ave., New York 19, N.Y. \$4.95 263 pp.

This book gives the framework of the helicopter without specialized technical jargon

Aircraft and Missile Propulsion-Volume No. 1- by M. J. Zarcov-Pugh, John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, New York \$13.50 338 pp.

The beginning of a series of books dealing with thermodynamics of fluid flow and its application to propulsion engines. This volume is the beginning of a three volume work which is designed to aid the student and engineer

Fundamental Principles of Transistor - by J. Evans, Ph.D., A.E.C., Standard Telecommunications Laboratories, Farnborough, G.B., published by D. Van Nostrand Co. Inc., 125 Alexander Street, Princeton, N.J. \$6.75 267 pp.

Simple account of the theory of semiconductor devices provides explicit material on

transistors, junction transistors, diodes and preparation of p-n junctions and point contact transistor. Manufacture and special transistor types are covered illustrating transistor design problems, also some transistor rectifiers, transistor phases and performance of variable devices and comparators

Antennas Systems-Sponsored by Engineering Department-Pub. Engineering Publishers, Division of the AC Doubt Co., Inc., New York 55-108, 150 pp.

This book contains the proceedings of the second Electronics Industries Antennas and Antennae Systems Fair in 1958. For engineers and executives who have an interest in antennas

Cold Air Regulation & Flight Stability and Pilots' Guide-published by Aeronautical Publishers Inc., 2162 Sutter Blvd., Los Angeles 26, Calif. \$1.25

The 19th edition of this pilot's manual for 1958 contains government requirements, air laws and flying procedures applicable to all pilots. Included

are flight rules, radio-telephone use, air traffic control requirements for various pilot certificates, search and rescue services, air defense requirements, how to read weather reports and also a short, clear and simple weather explanation for the private pilot licensee

Aeroplane Design Manual-by Fredrick K. Tordoff, published by Princeton Publishing Corp., 2 West 45th Street, New York 19, N.Y. \$8.50 408 pp.

First published in 1938, this fourth



JetStar External Fuel Tanks

Lockheed JetStar has been fitted with atmospheric and long range fuel tanks in solving problem increasing aircraft's range to more than 3,000 mi. These photo shows 500 gal capacity drogue tank, flight and front crew fuel and refueling tanks filled with 400 gal glass tank. For flight fuel additional 1,000 gal of fuel can be added to the aircraft's 1,000 gal capacity. Photo shows a glass tank length, note extended speed brake. Lockheed JetStar has flown 3,165 mi nonstop using the glass tank. Company tested the tanks in reverse around the same flight. With drogue tank filled JetStar flew 1,900 mi in 3 hr., 23 min. at 41,000 ft.



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space projects
require Engineers and
Scientists to work on*

THE FRONTIERS OF SPACE TECHNOLOGY

Lockheed Missile Systems Division, recently honored at the first National Missile Industry Conference as "the organization that contributed most in the past year to the development of the art of missiles and aeronautics," holds such important, long-term projects as: the Navy Polaris IRBM, Earth Satellites, Army Kingfisher target missile, and the Air Force X-7 supersonic test vehicle.

To carry out such complex projects, the frontiers of technology in all areas must be expanded. Responsible positions in our research and development laboratories and in our project organizations are available now for high-level engineers and scientists.

If you are experienced in physics, mathematics, chemistry or one of the engineering sciences, your inquiry is invited. Please write Research and Development Staff, Sunnyvale 2, California. (For the convenience of those living in the East and Midwest, offices are maintained at Suite 745, 405 Lexington Ave., New York 17, and at Suite 300, 840 N. Michigan Ave., Chicago 11.)

FLIGHT IN THREE MEDIUMS

Several things set the Polaris apart from other outer space weapons in the ballistic missile category, for the Polaris program involves a wholly new concept of weapons.

1. It will be displaced forces beneath the surface of the sea.
2. It will be radically smaller than currently developed land-launched missiles, yet its payload will be as effective and its range the same as other IRBMs.
3. It will be the first operational outer space missile to employ solid fuel as a propellant.
4. It will travel through three media in a single flight: water, air, outer space.
5. Its launching base—a submarine—is not fixed but a mobile vehicle.

OUTER SPACE PROGRAM

Very little can be said about the Earth Satellite program at this time except that its success will necessitate advancing the state of the art in all sciences.

The Earth Satellite Project is perhaps the most sophisticated outer space program to reach the "handover" stage in the U.S. today.

ENEMY SIMULATOR

The Kingfisher is the nation's fastest target missile, developed for the Air Force and currently being reconditioned for the Army to test the accuracy of our newest supersonic weapons.

It is a range target vehicle with Mach 2-3/6 capabilities. The Kingfisher not only has the speed to match the defensive missiles, but can also simulate a vast array of supersonic enemy missiles and aircrafts attacking from great height. It is instrumented to score near misses and even theoretical hits without itself being destroyed.

It is recoverable from flight by parachute to be flown again, permitting weapon systems evaluation to be conducted at greatly reduced cost.

Lockheed /
MISSILE SYSTEMS DIVISION

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Modernize Now — For Growth and Profits

The **biggest challenge** facing American industry today is that of **thoroughly modernizing its plant and equipment**. This is the test period for companies to prepare for success — or failure — in the '60s. Success depends decisively on one key policy — modernization, for growth and profits.

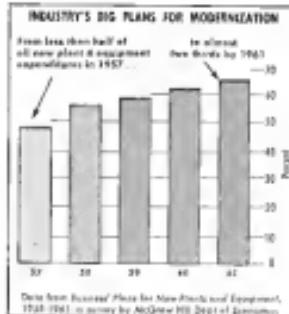
The problem of business recession is fading. Sales and industrial production are moving up again, slowly. Business is swinging back into its normal course. This is growth, not retreat and recession. If the recovery takes us back to the normal growth trend, industrial production will be up 15% to 20% by 1960.

But how can we get this growth in production without the plague of price inflation that has blighted our economy in recent years? And, of fateful consequence for the individual business firm, how can it keep its costs down enough to make a decent profit — something a very large share of American companies are not doing today?

This is the new challenge that confronts business as the recession is left behind.

Nature of the Challenge

The secret answer on costs and productivity is not reassuring. Since 1957 wages in manufacturing have risen 68%, while output per member has gone up 20%. This is a dismal record for a nation that has prided itself on



price or industrial efficiency. Clearly, if we are to avoid continuing inflation, labor must key its wage demands more closely to productivity increases. But clearly, also, we must do so later in raising output per member. Otherwise, industry cannot hope to offer stable prices, and still make a profit.

What, then, is the answer? It is modernization of plant and equipment, the replacement of obsolete producing facilities with new and more efficient machinery and buildings. Only in this way can industry hope to increase production, hold down costs and make a good profit showing in the years of growth that lie ahead.

Industry's Answer

The chart on the preceding page shows how American industry is buckling down to the task of modernizing its facilities over the next four years. It is planning to replace old equipment with new machines that will raise output per worker not just 2%, or 3%, a year, but more like the 5% annual gain in productivity that this nation achieved in the years following World War II.

Since World War II we have had to contend with shortages of capacity and materials that have held back the job of raising productivity. But today the machines and techniques are available. And industry is getting set.

A broad sample of manufacturing companies surveyed by the McGraw-Hill Department of Economics earlier this year reported these plans: In 1958, expenditures for modernization will rise to 56% of total investment in new facilities — compared to 40% in 1957. And this emphasis will increase until by 1961, expenditures for replacement and modernization account for two-thirds of all capital spending by manufacturing companies. In dollar terms, manufacturers will spend more on modernization in each of the four years 1958-61 than in any previous year except 1957.

Can It Be Done?

These are big plans. Can they be carried out? Is it too visionary to hope that after a decade of expansion, industry can now find the outlets for huge amounts of capital investment in the area of modernization? The answers are important to business and the nation, because on this new wave of modernization depends our hope of holding down costs and prices, and also the prosperity of the vital capital goods industry — generators of boom and bust in our economy.

To ensure that industry gets the answers, McGraw-Hill's 34 business publications are now starting a coordinated effort — the largest editorial effort in the history of our company — to find, report and publish the opportunities for modernization at a profit, in the fields we serve. These special reports will begin in late September and will run through November, with appropriate coverage for the specific needs of each field. We are proud to share with industry the responsibility for making sure that no opportunity is overlooked in the drive to modernize now for growth and profits.

This message was prepared by the McGraw-Hill Department of Economics as the first step in our company-wide effort to report an opportunity for modernization in industry. The Department is also preparing a larger report, on modernization as a national problem, for publication in October.

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Donald O. McLean
PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

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ANNUAL INDEX

ARMAND H. BOURGEOIS	10	ARMAND H. BOURGEOIS	10
ARMAND H. BOURGEOIS	10	ARMAND H. BOURGEOIS	10
ARMAND H. BOURGEOIS	10	ARMAND H. BOURGEOIS	10
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LETTERS

Time and Language

Re Mai Man Edman's letter "Can Man Languages" concerning Expressman (AW, July 14, p. 14):

With the [pilot, USAF, and] one serving United Kingdom team—for some reason CAA wants to know what time it is in England as all are flight plans referring to "local time" get lost in the void of words, leaving us pilot and [pilot] to have to learn Spanish or Indian to talk to others, etc.—at this time to be the case that we are trying to implement. In an event of an emergency, neither of the two operators will just shake the stick, we will find it all right.

As American Reader
San Antonio, Tex.

F. S. I am a USAF Captain and General Staff Officer, and have had eggs, etc., late police action, Connecticut. For an ex-CIA high school graduate, major in intelligence and foreign languages, though

High Hats

In reference to the letter from Mr. Bush (Army) (AW, July 28, p. 94) concerning the article "Indian Team Presents a Foreign Language" (AW, May 19, p. 80) and the letter from Lt. Gen. Prentiss (AW, FID, Blue Angels) (AW, June 20, p. 85):

The three aircraft were indeed built in India, but they were not Indian fighters. They were the fighters of India's Blue Angels Naval Air Station's "High Hats" who headed the nation during the Boeing Thirties as they honed a legend for flight precision that still persists. At the 1959 Cleveland Air Show, just before we started the rest of Navy's team, we had the four Blue Angels headed by their leader, Captain Jimmie D. "Sarge" Tamm, take off together at the length of one mile line.

The Cleveland team consisted of Lt. C. E. O'Brien (Blue Angels), 1 Lt. (O) J. F. S. Keeler (Blue Angels), 1 C. (O) C. and Lt. (O) F. O'Brien (Blue Angels, Con-Cutter). There

is a J. F. Harris (USMC), 1st Major Av. Wing, MAUS (1st Vice, Blue Angels), Gold,

Tethered Flying

I have been writing to various sources at your several sources concerning just who made the first tethered flying. Not when the letter from Lt. Gen. Prentiss appears to indicate July 28, 1959, (p. 85) as which he pointed out, is the position of the 1959 Blue Angels showing "three supersonic Army fighters tied together from tail to tail" leading "... I thought I'd set the record straight."

Perhaps Mr. Aschen is not aware that the Army fighters in that formation did not fly. I don't recall the incident during that period. However, I do know that VFWB, the fighter squadron attached to the old U.S. Longrange Team in the height of the Cold War, did do this trick at the National Air Meet held in Cleveland. Av-

iation Field refutes the appearance of no credits on the letter related to the response's editor's confusion. Address letter to the Editor, Aviation Week, 520 Madison, 2nd Fl., New York 36, N. Y. Try to be more specific in your writing to generate identification. We will not print anonymous letters, but names of sources will be withheld on request.

part, Chicago, as 1959. One aerospace division can succeed in this job with each wing man to each of the three fighters having an isolated wing tied to his own leader's wing. (The position was then for three days, however, forced by the West Coast weather.) During the first day this division took off and never landed.

The last two days they also landed in the tail cockpit furnished the rest of the time each aircraft in turn, at the conclusion of which time, due to the wing being in this position, they were all pulled up.

The fighters were partly broken. The inner wing and wing tipoles were used to keep them from crashing to the ground to keep them well tethered. On the second day the leading one would break his leading pivot slightly and had to chop his trailing finer from that usual. At a cause greater use of his wing was necessary but the other two would not be pushed. They never landed that second day.

I know—and was one of the wing men! F. C. W. W. President
Candy USAF
Huntington, N. Y.

Dimensional Dilemma

I have just read the letter by Mr. Hugh C. Robbins, president of Baldwin Aviation Inc. (Long Beach, Calif.) (AW, July 21, p. 122) in which he states that "we are not unique in our concern over the 'dimensional freeze' or 'set me cold'." He comments that the "set me cold" problem of aircraft flying is merely an extension of the same problem encountered in highway traffic. I would like to add my support to his apparent position with the following example:

The balance of aviation continues to be lighter in materially a non-dimensional problem. Most of the time the design and development process should, indeed, in the events to a very narrow set of views. Any deviation from this set of views can be a large two-dimensional area with the potential for significant impact on the design. This is especially true for the design engineer in industries that are addition to small and large aircraft. However, there are many vehicles operating on the same mass and flight rate axes, such as the VFWB, that are not in the same dimension for mobility and running much smaller amounts of power, despite the fact that all radio waves at less than 25 mph are lost, enough aerobatics occurred on wide open sweep areas at this time that it was necessary to limit traffic to vehicles having to conform to the "one-dimensional" system.

Now, when we lower the guard in as much as we can, we are still limited, and, in addition, the relative closing speeds are increased 30 to 15 times. As can easily be seen, this worsens the recognition problem exponentially. The simple mathematics of increasing the rate to be observed at a given distance by the third power, and decreasing the time required for recognition to an tenth of that, represents a frightening trend.

1. Consideration of an traffic problem,

overseas or domestically, as merely an extension of highway traffic problems [and

Mr. Robbins states that even a supposed

dimensional freeze can do that] is not only misleading (as above), but also dangerous short-sighted.

2. Given the relatively simple problem of highway traffic control and service perfor-

mance as in the capacity of stops, and

not to mention the problem of traffic control for railroad control facilities, the problem of having problems increase over

cycle time is obvious. Indeed, perhaps

part of the answer for the failure is that

these trying to solve the problem are still

using the one dimension while we are

using in the three.

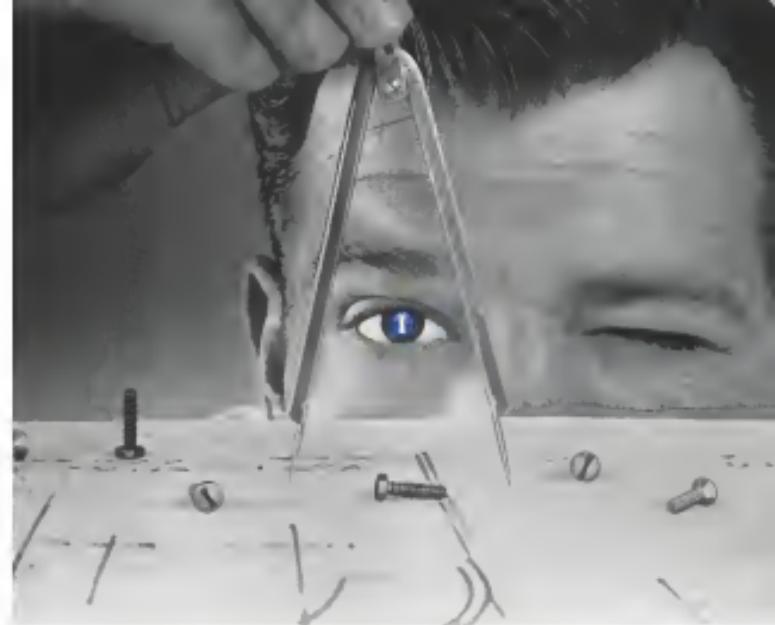
Mr. ROBERT D. COLLIER, USAF
Mo. Sq. Svc. 31st Bomb Wing
Randolf AFB, Wash.

Bells in Oil Hunt

Our president has had our study on p. 37 of Aviation Week, Aug. 4, entitled "Vermont 44 Adds an Oil Search." The whole is accurate in as far as goes. However, the main portion of the article concerning the much used of Mississippi River's delta has been omitted. On the same p. in addition to the Vermont 44 supplied to India, there are two Model 47G-2 supplied by Black Helicopters. In this respect, we take note with some concern that the much Bell 47 helicoptrers have been used in the Mississippi River delta. They have been used and found unsatisfactory. Additionally, they cannot do the job of lifting the research drilling rig and the instrument check in this same range as the Vermont 44 and 5000 ft. each. However, if Black Helicopters can be induced to put this whole operation with a Vermont 44, the use Bell 47 up to the p. 37 does not fit the "big" and pull the "tug." In addition, they can assist to shuttle personnel between the various geographical regions as they are surveyed. We do not wish to detract from the performance of Bell 47 in this application.

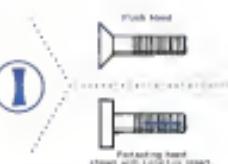
It has been and continues to do a excellent job. We feel, however, that the Bell 47 is unsuited by Black Helicopters should be as on the line above of the eight Bell 47 to as far as India, as the rest of all believe. However, if it is not possible, a double or a much open aircraft should be considered before a decision is made.

R. G. Evans, Jr.
Vice President and Manager
Black Helicopters
Pt. Worth, Tex.



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